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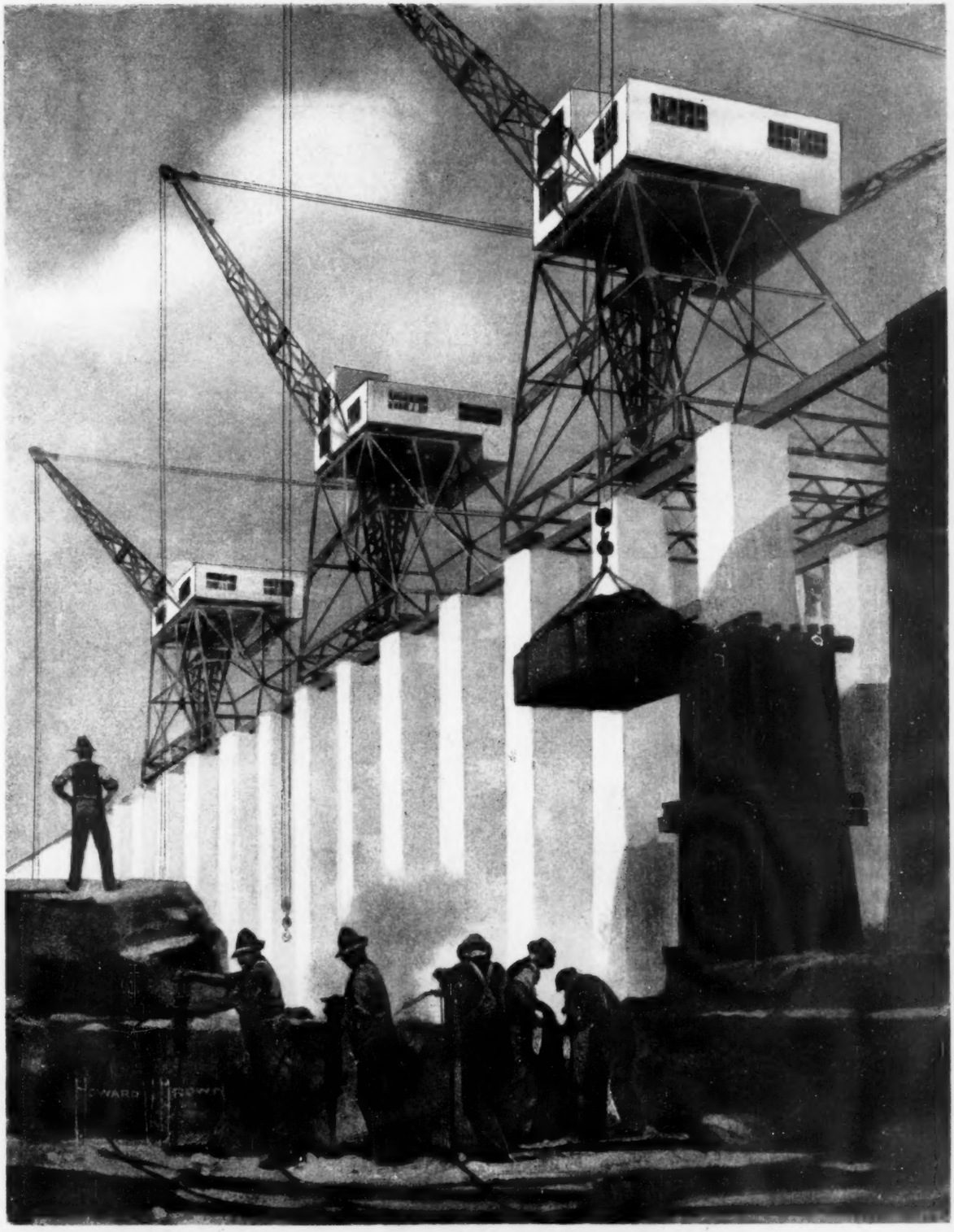
MACHINE-MADE WINDOW GLASS

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



AMERICA'S GREATEST DAM IN THE MAKING: THE WILSON DAM AT MUSCLE SHOALS.—[See page 364]

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May 7, 1921

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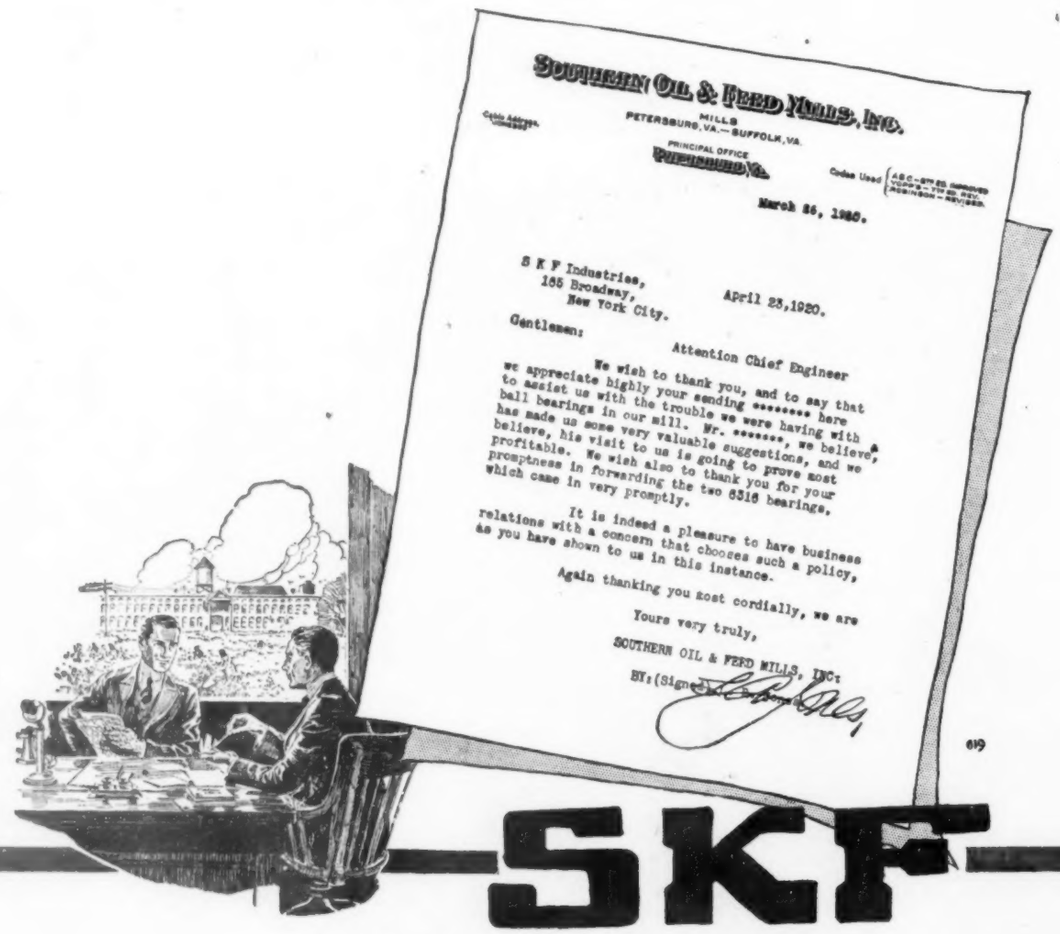
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It is indeed a pleasure to have business relations with a concern that chooses such a policy, as you have shown to us in this instance.
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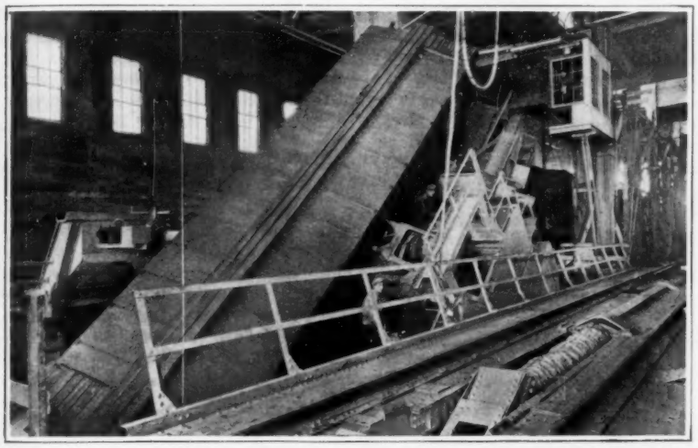
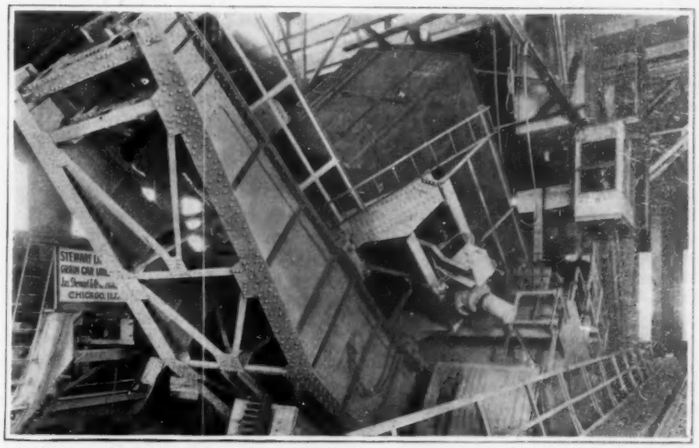
VOLUME CXXIV. NUMBER 19] NEW YORK, MAY 7, 1921 [15 CENTS A COPY 20 CENTS IN CANADA



While three or four men are employed in emptying each car, the bulk of the work is done by the operator in the control house shown in the upper right-hand corner



Grain car tilted endwise at an angle of 45 degrees and sideways about 30 degrees. The effect of four unloaders working at once is a bewildering one to the onlooker

Tilting Grain Cars in All Directions to Empty Them

By John Anson Ford

FROM now on a considerable portion of the world's daily bread, as represented by the large quantities of grain that go from Baltimore, Md., to foreign ports, is going to be handled with greater dispatch and economy than ever before, because of the mechanical features which have been incorporated in the Pennsylvania Railway's Northern Central grain elevator in that city. Among the outstanding features of this modern structure are four giant electric grain-car unloaders—the first machines of the sort ever built—grain bins with a capacity of 5,000,000 bushels, an unloading pier 900 feet long occupied by six belt conveyors 42 inches wide, ingenious fire alarm and other safety apparatus. While the elevator is surpassed in bin capacity by a few others of the most recently constructed elevators, no other has so many novel and remarkable features.

The most striking of the equipment features mentioned are the unloading apparatus. There are four of these giant machines, each of which will take a grain car in its grip, tilt it endwise and then sidewise and finally at an angle combining both the endwise and sidewise tilt, until, in the space of five to eight minutes, the car has been emptied. Formerly the best time that could be made in emptying a car of grain—that is, with hand shovelers—was 30 to 45 minutes.

With the assistance of a barney or "pusher" the car to be emptied is shoved on to the track of the unloader. Under the direction of a skilled operator, housed aloft in a windowed shelter, powerful clamps rise from below the track level and engage the ends of the car in a vise-like grip. Then a grain-door remover comes into play at the sides. Formerly the method has been to hack out this door—an inside grain-tight barrier—with an axe or otherwise break it out. These doors now cost about $11 each, and an elevator handling several hundred cars a day is necessarily destroying a good deal of property. This new mechanical apparatus is provided with sharp prongs on its inner surface which penetrate the grain door. Once securely gripped in this way, the door is pressed inward about 6 inches without being broken. This permits the grain to be poured out as the car is tilted. The unloader will tilt the car up sidewise to an angle of 30 degrees, and endwise to an angle of 45 degrees. The elevator has a receiving capacity of 320 cars per day when all four of the unloaders are working simultaneously.

Two of the powerful clamps holding the grain car in place, one in the foreground and the other pressing against the lower right-hand corner of the car

The new Baltimore structure has the greatest grain storage capacity of any on the Atlantic coast. Its belt conveyors, bin emptying apparatus and weighing apparatus are so designed that 60,000 bushels an hour can be loaded into one hatchway of a vessel if desired. Fourteen belt conveyors carry the grain from the headhouse to the storage bins and drier.

The elevator heads, delivering the power by which the grain is carried to the top of the elevator, are of novel construction. The motors are connected directly with helical cut herring-bone gears which effect the reduction in speed for the elevator pulleys with a loss of only two and one-half per cent in efficiency, as against a loss of 15 per cent if rope drive were used. The flywheel just outside the housing of these gears is so constructed that it serves as a backstop, being provided with an automatic braking device which prevents it reversing its action when the rising grain lifters are for

(Continued on page 375)

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The Roger Bacon Manuscript

MANUSCRIPTS from olden time turn up now and again; but seldom has one of these bits of salvage from bygone days been of more real interest or claimed more general attention than the one presented to the world at large in Philadelphia on April 20th and 21st.

This manuscript can safely be pronounced a product of the 13th century. It consists of text and drawings, mingled in a way and a proportion which cannot fail to attract the expert eye. The text is plainly a cipher of some sort. The manuscript is accompanied by a letter of presentation from one owner to the next, of the late seventeenth century. So much is certain. The steps by means of which Mr. Wilfrid Voynich, the owner and discoverer, has satisfied himself that the manuscript is from the pen of Roger Bacon, the man born 500 years too soon, require no repetition here; we shall present them in the SCIENTIFIC AMERICAN MONTHLY for June.

Now a cipher manuscript from Roger Bacon, profusely illustrated, ought on its face to be of the utmost importance. There is a good deal of *a priori* possibility that if it could be read it would be found to give an account of scientific knowledge possessed by Bacon which it had been immediate death as a sorcerer for him to impart to his own generation. Professor William R. Newbold of Philadelphia, who has been working on the manuscript for several years, has got far enough to place on public record his conviction that this is precisely what it is.

It must be admitted that one's first impulse on examining the evidence is toward rejection. That impulse we believe does injustice to the case. There can be no doubt that if a scientist in almost any other field were to state conclusions with as little evidence, and this so tenuous and of such doubtful applicability, he would be hooted off the stage and out of the pages of Who's Who. But evidence of the sort that satisfies the mathematician or the physicist is hardly attainable in dealing with a document which has just turned up, and whose past history must necessarily be a good deal of a blank. To authenticate it fully, we should have to establish by independent documents each change of ownership through which it went from Bacon down, with the circumstances of each transfer. If its prior owners were all here to testify it is doubtful that we could do this; certainly with them dead for centuries we cannot do it. All we can hope to do is to show a reasonable sequence through which the manuscript *could* have passed, so as to forestall the claim that it cannot be from Bacon or whatever the source claimed; and Mr. Voynich has done this, and has been particularly successful in showing the possibility of the manuscript's having passed from Oxford to Prag.

Translation of the cipher too opens the door to doubt. Professor Newbold states that this is so difficult and uncertain as to be surely a task for numerous scholars and many years; he doubts that the text will ever be read in its entirety with scientific accuracy. Nevertheless he has read in it at least two statements of fact of which he was ignorant but which have subsequently been verified, one of them being no less obscure a thing than the date of an annular eclipse of the thirteenth century. Again, it is true that the parts of the manuscript so far "read" contain much of mysticism and symbolism so repugnant to modern science that it impresses us as not creditable to a man of Bacon's intellect; but we should be more conservative than this in estimating the degree to which Bacon, with all his abilities, was really able to emancipate himself from the fundamentals of the 13th century in which he lived.

In an early issue we shall give an account of the manuscript, the difficulties of translation, the apparent nature of the text, etc. We believe a fair statement to be that the authenticity of the document as a Baconian cipher, and the accuracy of the interpretation, may be supported without placing their proponents in an untenable position. More than this perhaps we shall never be able to say in any similar case. In any event, the thing is on a basis of respectability which makes it out of the question to classify it with the trivialities or the outright frauds; the very worst verdict we can bring in is the good old Scotch one of "not proved."

Admiral Sims Vindicated

WE have before us a book, "Naval Lessons of the Great War," which we would like to see in the hands of every member of Congress and every citizen who takes an intelligent interest in the Navy. The book is a digest of the four months' hearing held by a Senate committee to investigate the charges made by Admiral Sims that the Naval Administration at Washington was guilty of inexcusable inefficiency, delay, and lack of cooperation with our Allies during the first six months of the war. Admiral Sims made no such charges against the officers and men who fought the war, of whose splendid work he has always spoken in terms of fine appreciation. His charges were directed against Secretary Daniels and the clique of officers that he selected to carry out the policy of apparent indifference to the dire needs of the Allies which characterized the first few months of his war administration.

The value of this book, which was written by Lieutenant Tracy Barrett Kittredge, U.S.N.R.F., formerly on Admiral Sims' staff in London, lies not merely in its revealing how completely the Senate Investigation served to vindicate the Admiral (we all expected that), but in its revelation of the crying need for a reorganization of the Navy, more particularly in respect to giving full authority to the technical advisers upon whom the civilian Secretary must necessarily depend.

So far as Admiral Sims is concerned, the reader lays down this digest of the testimony with an increased admiration for the ability and farsightedness with which he filled his responsible position, and the truly marvelous patience and tact with which he endured, for the sake of the Great Cause, the calculated neglect with which Daniels and his immediate advisers treated their own chosen representative to the Allies.

So far as the Secretary is concerned, the testimony, even of the officers whom he called in rebuttal, served to establish the truth of the Sims criticisms. It shows that from the very outbreak of war in 1914, the fearless and patriotic among the officers of the Navy urged upon our pacifist Secretary the imperative necessity of preparing for war. One by one, these men, beginning with Admiral Fiske, were flouted and forced out of office, so that by the time the war broke, Daniels had gathered around him a staff of such definite color, that its principal member dared to say in the name of the people of the United States that we would as soon fight our Allies as the Germans!

But this sort of thing was utterly foreign to the fine spirit shown by the Navy. As a sample of the attitude of the Navy as a whole, we quote the fact, as brought out in the evidence, that Admiral McKean, on July 20, 1917, *over three months after the war began*, was so stirred up by our failure to cooperate earnestly with the Allies, that he considered it necessary to address a memorandum to the Secretary in which he wrote: "With an earnestness beyond expression, backed by a conviction that has endured from the first, I ask that we meet this great world crisis by contributing our maximum national effort in building, manning and fighting destroyers to drive enemy submarines from the sea. . . . The question of types may rest for the moment *while we make the great decision to do our utmost*. Let it not be said by posterity that we, seeing our duty, hesitated until too late, or that we failed to distinguish essential from incidental effort." And this was one of scores of such communications addressed to the Secretary by officers who could no longer keep silence.

Mr. Kittredge tell us that the officers who fought for sound organization, for naval preparedness, for the placing of the primary emphasis on the naval rather than the civil aspects of the Navy, were forced out of responsible positions. The result was fatal to the spirit and morale of the service. Stagnation or cynical despair often took the place of the old splendid spirit of the Navy.

Mr. Daniels must have realized, before the hearings opened, that if he based his defense upon the facts and the record, he would be beaten. Hence, he turned to personalities, and accused Sims of being pro-British—an attitude which was highly commendable if our heart was with the Allies, but was highly censurable if we would as soon have fought the Allies as the enemy. The Secretary proved to be a tactician—of a sort. When the able cross-examination of Chairman Hale so shortened the range that Mr. Daniels was beginning to be heavily hit by high-explosive shells, he sent up smoke screens in the shape of long statements that had no bearing whatever upon the question. Hence the seemingly immeasurable patience of the Chairman at last gave way, for Senator Hale thus addressed the witness: "My idea was that when we examined you here we would get all the assistance that it was in your power to give. . . . Nobody wants to hide anything or suppress any information . . . Every question we ask, you come out with a long statement taking up all sorts of other matters, and we never get anywhere."

Altogether, taking it by and large, we are glad that this controversy arose. Admiral Sims struck a brave blow on behalf of the morale of the Navy and got results. The outcome of the matter will be a reorganization of the Navy in certain respects where it is urgently needed. Daniels is gone, and in Secretary Denby we have the type of American that understands the fine spirit of the Navy. As Secretary he has already won the full confidence of its officers and men.

The Yacht "America" to Be Preserved at Annapolis

AS a fitting close to a yachting career which, for variety and vicissitudes, is surely unique, the famous yacht "America," by the courtesy of the Eastern Yacht Club of Boston, has become the property of the Navy Department and will find a permament home at Annapolis. But let no one presume that the schooner "America," as she swings at her moorings in the York River, is literally the yacht that won the cup in 1851. Of the craft which George Steers designed and William H. Brown built in 1850, it is probable that nothing remains except the lines of the midship section and a certain amount of the body.

The "America" sailed the race which made her famous on August 22, 1851. Five days later she was sold by Mr. Stevens to Lord John de Blaquière, who cut down her masts five feet and used her for cruising. In the following year she was bought by Lord Templeton, who sailed her for one season and laid her up at Cowes, in 1854. She was not disturbed until 1859, and when she was hauled out, the boat was almost falling apart from dry rot. She was bought by the owner of a yard near Gravesend, London, who, being a keen sportsman, entirely rebuilt her, thus saving this famous craft for posterity. The following year she was sold again to a Mr. Decie, who renamed her "Camilla."

In the year 1861 she was purchased by some resident of Savannah, Georgia, name unknown, who used her as a blockade runner and dispatch boat. In 1861, the United States gun boat discovered the "America" sunk in the mud of the river, and her captain, later Rear Admiral Stevens, made a gift of her to the Government for the use of the midshipmen at Annapolis.

The next and longest period of her life commenced in 1870, when she was bought by General B. F. Butler, who raced her with more or less success until the year 1880, when she was entirely rebuilt under plans by Edward Burgess, the designer of "Genesta" and "Puritan." Thirty years of improvement in American schooners proved too much for the good old "America," and although in 1885 she was entirely rigged and her stern lengthened, she failed to hold her own with such schooners as "Fortuna" and "Mohican." During the later America Cup races "America" was frequently to be seen under cruising rig.

Electricity

Safety Switches.—There can be no doubting the fact that the introduction of safety switches has resulted in the saving of many lives. These switches, which are made in many different designs, all work on the same general principle, namely, to encase the switch parts and the fuses in such a manner that they cannot be reached except by opening a door, which act automatically disconnects the current from all parts which then become exposed.

Coated Wires and Their Use.—For many technical purposes wires are used in which the central portion and outer coating are made of different metals. In the making of electric lamps, for instance, the leading-in wires are sometimes made of a nickel-iron core and a covering of platinum, gold, or copper, the former being so chosen as to have approximately the same coefficient of expansion as that of the platinum or the glass through which the wire is to be sealed. In general, however, the expansion coefficients of the core and covering are different.

Maracaibo Radio Station.—Work has been started on the new radio station at Maracaibo, Venezuela. This is the second of the three stations whose installation was authorized by the executive decree of June 18, 1920. The Maracaibo station will have a power of 5 kilowatts and the range will extend 500 miles during the day and 1,500 miles during the night. The towers will be about 160 feet high, and will be capable of receiving direct daily messages from the Arlington station near Washington, and from the station at Colon. The third station is to be erected at San Cristobal.

Radio Cable and Radio Compass.—In a recent issue of the *Proceedings* of the Institute of Radio Engineers, R. H. Marriott, after emphasizing the need for means sufficiently accurate to guide ships through narrow or dangerous channels, or in fogs, urges the installation of signal-carrying conductors under such dangerous waterways. Means of indicating to the navigator the proximity and direction of the signal conductor are discussed and experiments described in detail. It is suggested that radio compass stations should be used to guide vessels to harbor entrances, where the guide signals could be picked up from a submerged cable and followed into berth.

Sweden's Huge Cable.—Twenty-four car loads of underground cable apparatus now on its way to Stockholm, Sweden, is part of a gigantic underground cable system which the Swedish Government intends to install between Stockholm and Goteborg, according to the *Journal* of the A.I.E.E. It will be 320 miles long. When completed, it will be the largest underground cable line in Europe, and second in the world only to the 450-mile line now operating between Boston and Washington. It will be capable of carrying two hundred conversations simultaneously from Stockholm to its other terminus. To complete this big project, it will be necessary to manufacture a total of 425,000,000 conductor feet of cable, 25,000 loading coils and 8 repeater stations with 300 repeaters.

Wired Wireless in Germany.—Whereas up till now direct current has been used for telephonic communication, we learn from *The Technical Review* that a new method of producing electrical oscillations makes it possible to carry on a number of alternating current conversations over the same wire. Dr. Meissner has been conducting experiments with three-electrode vacuum tubes along this line in Germany. The oscillations created by these tubes can be varied according to requirement from 5,000 to 1,000,000 per second. For the human voice only between 10,000 and 50,000 oscillations per second come into consideration. Within this range as many gradations can be introduced as may be necessary for the simultaneous transmission of fifteen conversations over a single wire without causing trouble or inconvenience.

A Year's Progress in Radio Telephony.—In connection with research work at the Bureau of Standards on radio telephony, it is necessary to keep in touch with progress in this subject elsewhere. A review of recent developments and achievements has been prepared for publication in the electrical press. The past year has witnessed steady progress and increasing public interest in radio telephony. Voice transmission by radio waves has advanced from the experimental stage to established practice, for distances of a few hundred miles, and since all inherent difficulties have been surmounted, it is actually possible to carry on reliable radio telephony over as great a distance as ordinary wire telephony. It seems probable that commercial telephony across the Atlantic will be an established fact in the not far distant future.

Science

Pimento Leaves As a Source of Vanilin.—The Department of Agriculture of Jamaica is continuing experiments in the manufacture of vanilin from pimento leaves. A trial shipment of the oil was made to England a short time ago, and was sold at $2.50 per pound. It contained a higher percentage of eugenol than clove oil. Results have shown that it was more profitable for the colony to manufacture vanilin.

Flavian Movies.—The Coliseum in Rome, one of the most valued relics of antiquity in the entire world, has been leased to a moving picture company for a term of years so we may expect more films of gladiators, early Christian martyrs, lions, etc., in the near future. The lease of the Italian government is in questionable taste, even for a country in need of every possible source of revenue.

Parsley an Absinthe Substitute.—Substitution, particularly in alcohol, is the order of the day and even poor France has her own "moonshine" problem. A sudden shortage of parsley, so universally used for cooking and garnishing in France, became apparent. It was found that manufacturers were buying it up to make a substitute for absinthe. As usual the spurious product is more powerful and deadly than the outlawed green liquor.

Congo Paper to the Rescue.—The papyrus of the Congo has shown on analysis to contain 37.8 per cent of cellulose. After research and experiments, a process was discovered for bleaching the plants which had been vainly sought for 50 years. The American Consul General at Brussels states that it is planned to establish near the river a large plant, costing two and a half million francs, which will have an initial production of 20,000 tons of pulp.

The Airplane Tabooed for Duck Hunting.—Criminal proceedings have been instigated against those in charge of an airplane which crashed into a flock of wild ducks, killing a large number. Pictures in a motion picture news-weekly were seen by true game lovers and complaints were sent to Washington with the result that an agent was sent to California, where the incident occurred, with instructions to prosecute for violations of the Migratory Bird Act.

Black Walnut to the Fore.—Black walnut, that wood which was so much in request for furniture in the last century, came into its own during the war. The uses for this wood were numerous as for airplane propellers, gunstocks, etc., and the nutshells were calcined and used for gas masks. The Department of Agriculture is encouraging the planting of black walnut trees everywhere. This tree played an essential part in winning the war and a future supply should be encouraged.

New Assay Office Open.—On several occasions we have illustrated the operations carried on at the United States Assay Office at New York. The new section has just been opened, the entrance being on Wall St. The opening was delayed on account of injury to the building by the bomb explosion on September 16th last. A vault of five stories entirely below ground serves to contain $5,000,000,000 in gold, if that much bullion should present itself. The Secretary of the Treasury has also asked for more bullion storage space in Washington.

107 Uses for the Sweet Potato.—A negro scientist of Tuskegee, Ala., has discovered manifold uses for the sweet potato, that near relation of the peanut, yielding everything from ice cream to ink. Mr. Carver enlightened the Ways and Means Committee of Congress and incidentally asked for a little "protection" on the products of Southern soil. Said Mr. Carver, "Here is a bottle of mock oysters. Here is a bottle of relish for the oysters, made from peanuts. Peanuts make fine cereal coffee. The sweet potato products number 107 up to date. I have not finished working with them." So, after all, some of the tariff hearings are not so dull and humdrum as one would think.

Mustard Gas Quickly Identified.—According to Lord Haldane, mustard gas was not known in Europe before the war, yet forty-eight hours after it was first used by the Germans, British chemists had run it to earth. It was not discovered by the Germans during the war, as has so often been erroneously stated. When Lord Haldane was a student at Göttingen, he often walked round the walls of the university town and noted the chemical laboratory just outside. Professor Meier was in charge, and came across the gas many years ago. He recorded the discovery officially, and two British men of science remembered the paper he had written and identified the gas, says the English *Mechanic*.

Naval and Merchant Marine

Storm Warnings by Radio.—The Shipping Board announces that henceforth most of the high power radio stations will send out broadcast storm warnings on schedules furnished to Shipping Board radio operators. Ships without radio are directed to ask those which have it to signal weather warnings to them by international code or by any other means that are available.

New High Records at Panama.—The aggregate net tonnage of commercial ships using the Panama Canal in March, 1921, was 1,112,818 tons, as compared with 1,094,323 tons in January, 1921, which was the month of high record previous to March. The tolls in March were $1,105,529, as compared with $1,095,857 in January. In March of last year, the tolls from commercial traffic amounted to $831,304.

The Last of the Centrifugal Gun.—After testing out the centrifugal gun at Aberdeen Proving Ground, the Ordnance Department has decided that because of its great weight and its inability to obtain high initial velocity no centrifugal gun can have military value. The centrifugal gun is a perennial. This last report is one of several adverse judgments that have been pronounced against it by expert authorities.

The Bulge an Effective Protection.—In a recent paper, the Chief Constructor of the British Navy in speaking of the protection afforded by the bulge, said that the cruiser "Hawke", which had no bulge, sank very quickly after being torpedoed. As a result, bulge protection was fitted to the other vessels of the class. Three of these were subsequently torpedoed, and all of them succeeded in reaching port.

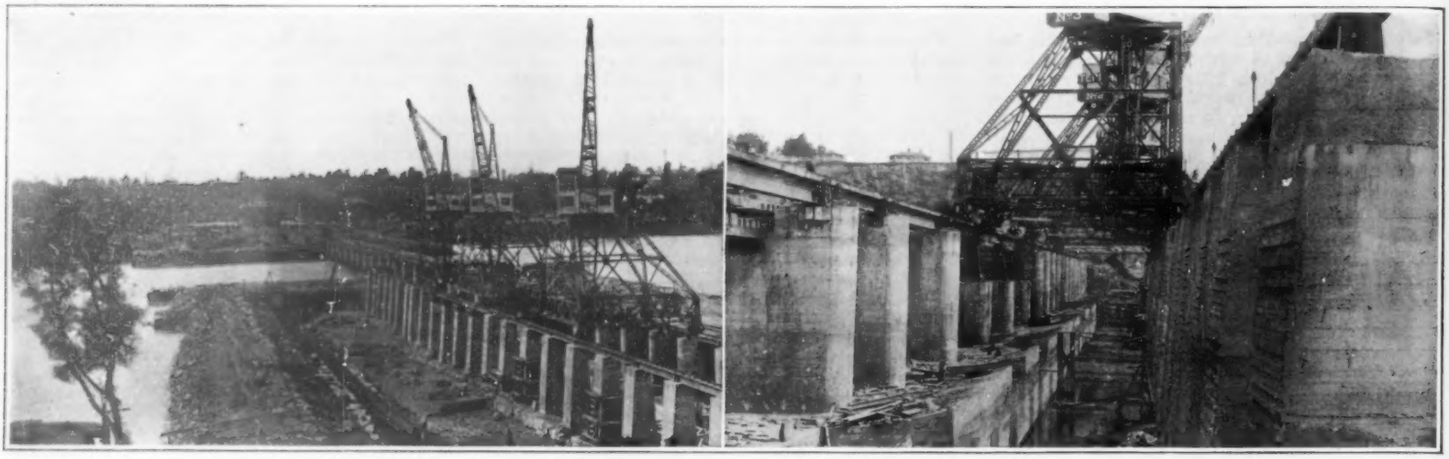
Rebuilding Germany's Merchant Marine.—It is estimated by a representative of our Department of Commerce in Berlin that Germany has today a total of about 665,000 tons of shipping, consisting of 500,000 tons left to her after the Peace Treaty, and about 165,000 tons which she has built since the Armistice. This is to be compared with the fleet of 4,935 ships, representing 5,240,000 gross tons which Germany possessed at the outbreak of the war.

Organizing Barge Canal Service.—Canal lines operating over 200 modern barges and boats have recently joined the Great Lakes-Hudson and Atlantic Waterways Association, and will agree to establish uniform canal rates, give through bills of lading, and apply ocean transportation facilities to their fleets. It is announced that Captain McDugall, the designer of the original "Whaleback," will place five 1500-ton self-propelled barges on the canal this summer.

Our Fleet To Be United.—The serious strategical mistake of the Daniels administration of dividing the fleet is to be rectified. The probabilities are that three-fourths of the Navy will be concentrated in the Pacific. In this connection, we note that the Bureau of Economics at San Francisco calls attention to the fact that the California oil situation will have an important bearing on this matter, and it is suggested that California will greatly assist the matter of oil supplies for the Navy by a further and considerable development of her water power. The greater this development, the less will California have to depend upon oil for industrial and municipal purposes.

Oil for Coal.—In view of the superior economy of the motor ship to the coal-fired steamship, the Munson Steamship Company suggests that it would be advisable to change some of our Shipping Board's vessels to motor ships. The suggestion would be good at any other time but this, when Congress is straining every nerve to cut down the national expenditures. According to *Marine Engineering*, the amount of oil used in motor ships is only about 40 per cent per shaft horsepower of that used in oil-burning steam installations. This comparison indicates that the motor ship will be a paying proposition long after the coal-burning or the oil-burning steamship has ceased to run.

The German Dreadnaught "Baden" as a Target.—In the course of a paper by the Chief Naval Constructor of the British Navy, read before the Society of Naval Architects of Great Britain, the writer discussed the design of the latest German dreadnaught "Baden," which has recently been used by the British as a target for heavy gun fire. He said that, on the whole, the ship showed no superiority in design or construction to British ships, with which statement Commander Land, of the United States Navy, in his subsequent comments on the paper, stated that he was in full agreement. Commander Land stated that German construction steel was somewhat superior. The "Baden" tests showed that, because of war limitations, the latest armor plate as carried by the "Baden" was not so good as the British.



Left: A close-up of the work, taken from the north shore, with Jackson's Island and the south abutment in the background. *Right:* A portion of the apron section of the dam masonry in place around the piers of the construction bridge

Details of the work already done on the Muscle Shoals or Wilson Dam

America's Greatest Dam

The Muscle Shoals Project on Which Congressional Economy Is About to Force a Halt

By W. B. West

THIS story of the Muscle Shoals undertaking was written by Mr. West several months ago, at a time when nobody had the slightest idea that work on this great barrage was not to be carried right along to completion. Since that time, Congress in its economy program has refused to appropriate the money necessary to go on with the work, and as a consequence the work will have to stand, as now, 30 per cent completed until funds are again available. There remains to be poured about a million cubic yards of concrete, and at the rate of which work has progressed on the dam this would take only 25 months. The organization of the working staff has been brought to a high condition of efficiency, and for the past few months 4,400 men have been working to unusual effect on the job. Unless immediate provision is made to the contrary, this force will have to be disbanded even before the end of the fiscal year in June, in order to conserve funds for the proper care of the structure pending a resumption of activity. The annual loss in deterioration and in interest on the idle capital represented by the dam will be greater than the annual appropriations necessary to carry on the work. All this seems a great shame, and we believe that with the project so far along toward completion the part of economy would be to finish it now. As the best presentation of this viewpoint which we could make we give Mr. West's story in just the form in which he prepared it when it was assumed that as a matter of course the dam would be completed.—THE EDITOR.

FOR years Congressmen, engineers, business men and others advocated the construction of a dam, or series of dams, across the Tennessee River at a point in north central Alabama, commonly known in that vicinity as "Muscle Shoals." This is simply a rocky, shallow place in the Tennessee River which prevents the passage of steamers up and down the stream. Many weird Indian tales and other stories are told of Muscle Shoals. It is said that during the Civil War so many horses were made to ford the river there, when a certain Federal army was crossing, that the rocky bottom was almost covered with horse shoes.

The advocates of a dam at Muscle Shoals pointed out that such a dam would make the river navigable for almost its entire length from East Tennessee to Cairo, Ill., thus opening up a vast amount of territory to cheap water transportation.

As a result of the agitation, the country adjacent to Muscle Shoals was carefully surveyed some years ago. So when we entered the war in such an unprepared state, and when it was found that we must have nitrate for explosives, quickly and in large quantities, the advocates of Muscle Shoals made their claims well known. They proposed to build the dam so that power could be generated for the manufacture of ammonium nitrate for explosives and at the same time the dam and locks would make the river navigable for almost its entire length.

After careful consideration, the Federal Government finally decided to build a great nitrate plant at Muscle Shoals for the manufacture of ammonium nitrate by the cyanimide process and to be operated by steam-generated electrical power until the great dam could be completed. It was further planned to use the plant after the war for the manufacture of nitrates for fertilizers as is being done in Norway, Sweden, at Niagara Falls and elsewhere.

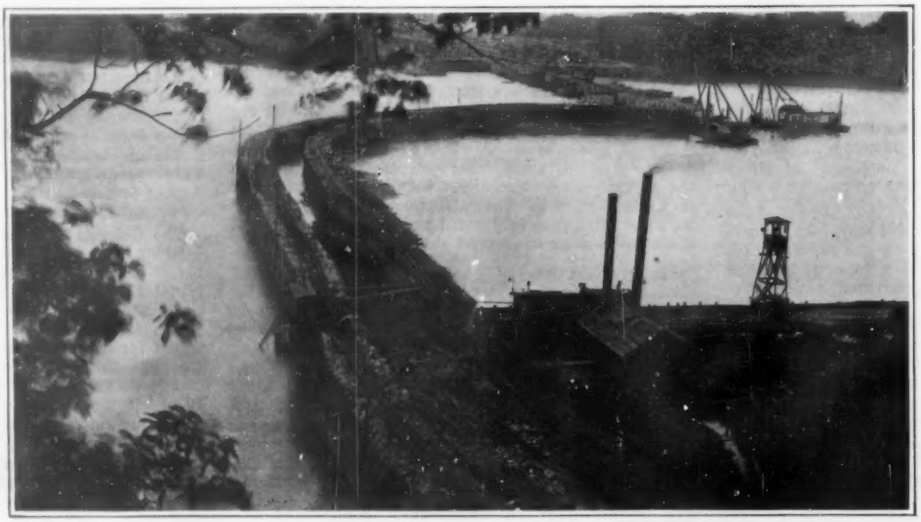
The nitrate plant was practically completed and was in successful operation for a period of two months before the armistice was signed. While it cost an appalling sum of money, yet a wonderful piece of work is there to show for what was spent. Owing to the scarcity of coal, the nitrate plant was shut down until the great dam should be completed, a period roughly estimated at from three to four years.

The Wilson Dam which is now under construction at Muscle Shoals will have, when completed, the largest volume of any masonry dam in America. After making a careful search in engineering literature and records, the writer finds that it will be the largest in the world except the Assuan dam across the Nile River in Egypt and possibly the Vyrnwy Dam in England. The two former will be exactly the same height; the Wilson Dam will be somewhat longer while all will have very nearly the same volume.

The accompanying diagram shows the comparative size of the Wilson Dam and a few other famous great barriers. The Wilson Dam will have a volume of nearly 1,000,000 cubic yards of concrete. If one concrete slab 1½ inches thick by 18 inches wide suitable for one person to use as a walkway were built of the material, the walkway would extend entirely around the earth.

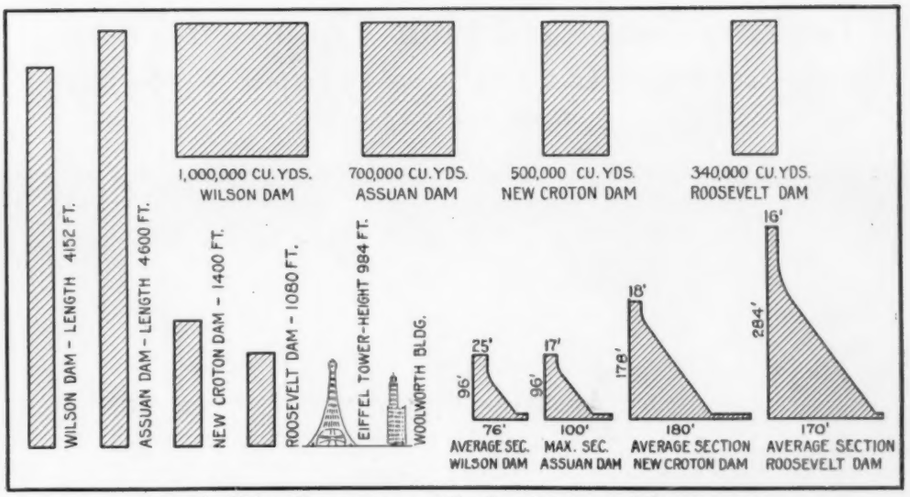
In comparing the Keokuk Dam of the Mississippi River Power Company with the Wilson Dam as it is to be when completed, we find that while the former is over 4,000 feet long and 53 feet high, by 29 feet wide on top and 46 feet wide at the bottom, the Wilson Dam will also be considerably over 4,000 feet long, and will be over 98 feet high by 27 feet wide at the top, and 76 feet wide at the bottom. Thus it is seen that the Wilson Dam will contain considerably more masonry than the Keokuk Dam. The Keokuk hydroelectric development is generally acknowledged to be the largest in the world.

The famous Quaker Bridge Dam of the New York Aque-



The downstream arm of coffer No. 6, and its connection with the construction bridge

duct Commission is over 1,300 feet long and 270 feet high, but is much more lean in sectional dimensions. The Roosevelt Dam does not come in its class at all for this dam is very short and high. It is therefore seen that the Wilson Dam will actually be the largest dam in America. The Assuan Dam across the Nile River in Egypt is 4,600 feet long and is exactly the same height as the Wilson Dam will be when completed. It has a volume of 700,000 cubic yards of concrete. The Wilson Dam will have a volume of between 700,000 and 1,000,000 cubic yards.



How the Wilson Dam compares with other structures of the same sort

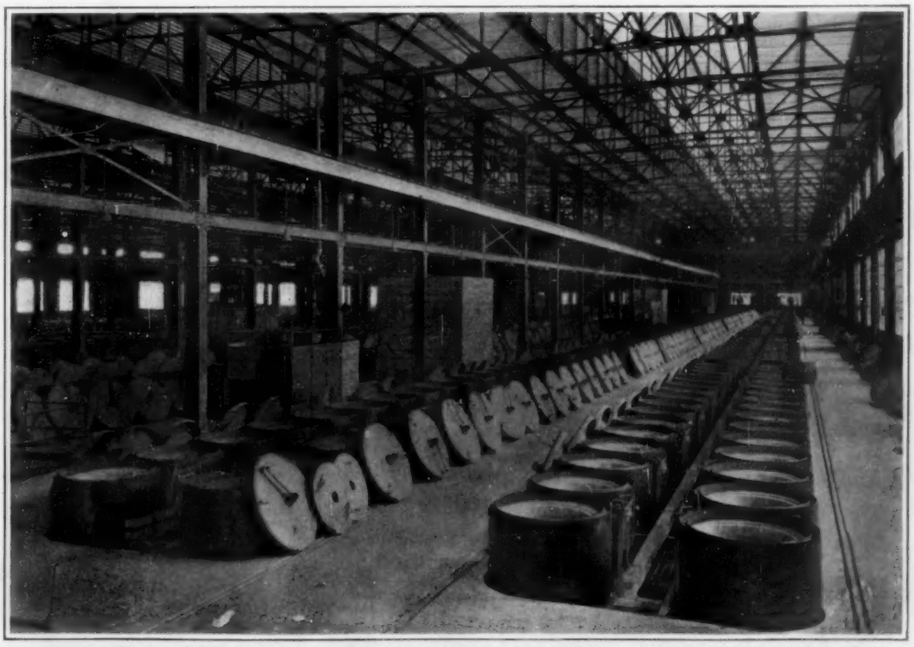
Not only will the construction of the Wilson Dam make the Tennessee River a very valuable waterway and enable the nitrate plant to be operated for the manufacture of fertilizers, but it will also provide cheap power for other industries that may want to locate at a desirable place where labor conditions and transportation facilities are so well adapted to such as at Muscle Shoals. Muscle Shoals is situated approximately midway between Memphis, Nashville, Chattanooga and Birmingham. The general local conditions which influence the methods and time of constructing the dam are especially good. The project is well situated in regard to the labor market. Sand, gravel and stone for concrete are also at hand. Railroad facilities are also good, as there are two roads near the site of the dam. The river is of great service in bringing in construction materials, and electric power is available for construction purposes at reasonable cost. Power at present is furnished by the Alabama Power Company from their Lock 12, hydro-electric development and the Warrior River steam plant, the former being 140 miles away, while the latter is 90 miles south of Muscle Shoals. It is interesting to note that this Warrior River plant is in the very heart of Alabama's coal mines, being at the very mouth of some of the mines on the banks of the Warrior River. (See author's article, "Warrior Steam Plant of Alabama Power Company" in *Power and Electrical Review* of March 19, 1918.)

Power is supplied from these plants over a single circuit, three-phase stranded copper transmission line. The cables are each one-half inch in diameter, and are in a horizontal plane.

The power is transmitted at a pressure of 110,000 volts and is transformed to 44,000 and 2,300 for local distribution at Wilson Dam.

Muscle Shoals is also well situated for the manufacture of fertilizer. Phosphate rock is one of the principal ingredients of fertilizer, and is at hand in great abundance. The cotton raising states, which are the great users of fertilizers, are well within easy reach either by rail or water.

It is very advantageously situated for the development of a great manufacturing center. Unlimited sites are available. With the completion of the dam, excellent water transportation will insure lower freight rates. Moreover, the cost of building and heating is much less than farther north. There is an abundance of common labor, and it is a proven fact that skilled labor will flow to the point where there is a demand for it. With the growth and development of the Southern States it should be possible to supply their demands for many products from plants located at or near Muscle Shoals which now come from plants 800 miles farther north. Despite this it must be appreciated that it will require hard, honest work of trained experts, combined with a certain amount of financial assistance to bring the new industries to Muscle Shoals.



Interior of U. S. Nitrate Plant No. 2, showing 1536 electric ovens, to be operated from the power created by the dam

A Murder That Never Happened Solved by the Airplane

THE "Mystery of Edwin Drood," the unfinished masterpiece of Charles Dickens, had never been solved until recently, and there is some doubt as to its solution even now, but the work of Percy T. Carden (Putnam's), will go farther to satisfy the great family of "Droodists" than anything printed for many years. The author has applied Mycroft Holmes' methods, for we must remember that the almost-sure Sherlock appealed to that super-detective and relation Mycroft on very rare occasions. Mr. Carden has examined the manuscript with painstaking care and has made many interesting discoveries, but his most remarkable feat was in securing the coöperation of Major Sippe, D. S. O., of Short Bros., in taking some remarkable views of the Cathedral and its precincts of "Cloisterham," as Dickens has disguised the charming Kentish City of Rochester. The writer of this brief note attempted a few years ago to trace approximately the scene of the murder of Edwin Drood by John Jasper, but was unsuccessful, owing to topographical difficulties. But with the aid of the airplane, all is different. The seaplane flew low and the uncanny eye of the camera first at an elevation of 800 feet, and then at 500 feet unrolled the picture like a map. Here spread before us is the whole scene of the murder, the very graves and vaults which are referred to in the story. At last we can trace the comparative short journey from the stoneyard of Durdles, the perpetually inebriated mason, to the tomb where John Jasper cached the quicklime to obliterate the body of his murdered nephew. Step by step the many mysteries which surrounded the story are being solved. The greatest danger is lest the game one day should have an end in a complete solution. But that day is not yet, but is probably far removed. If Dickens, who had premonitions of sudden death, had only told his literary adviser, Forster, his son-in-law, Collins, who drew the cover, Sir Luke Fildes, his illustrator, or his son, Charles, how the story was coming out, what reams of paper would have been saved, for the literature on the subject is enormous, probably greater than for any other one book, excluding the Bible of course, so we turn and twist and split hairs usually to little purpose, but Mr. Carden has altered this with his modern methods and now we can confidently hope that this mystery of mysteries may succumb to these methods which the great creator of Sherlock Holmes never dreamed of.

Male Chicks from Large Eggs

A FRENCH scientist, Lienhart, has carried out experiments which indicate that there is a correlation between size and weight of egg and sex of chick. The heavier eggs were found to produce a large proportion of males, the lighter eggs a large proportion of females. For the successful application of the device, it was found necessary to use eggs produced by pure-breds and from a pen of hens out of the same brood. It was found desirable, further, to set eggs laid at the height of production, as there is an apparent tendency with all hens to lay eggs of less weight at the beginning and also toward the end of a litter.

The discovery, if such it can be called, has not yet been fully exploited, and its limitations as well as capacities shown. The reasoning which led to the first experiments is interesting.

The experimenter had observed that in all breeds and varieties of poultry the male is markedly heavier than the female. Through tests, he was aware also that this difference in weight was true of the chicks, being determinable in the first days of life. He reasoned that the difference in weight would also be apparent in the egg.

American poultry-raisers can be depended on to give the sex-determination plan of Lienhart a prompt try-out. The desirability of being able to regulate the proportion of pullets and cockerels in the hatch when setting the eggs is of prime importance. Setting eggs at present, the poultry raiser calculates on about fifty per cent females. The males are a necessary evil, so to speak. They are sometimes sold for broilers or fries at two months or later, in other cases raised to the roasting stage. This necessity to hatch many males which are not needed requires more exhaustive poultry equipment than would be needed were it possible to regulate sex of the hatches. Should sex-determination become practical, it would alter poultry conditions to a considerable extent, and result in the marketing of the prospective roosters in egg form, with the prospective hens reserved for hatching.

Looking Backward Four Thousand Years

The Story of a Digger's Luck That Opened an Egyptian Wonder House

By Albert A. Hopkins

The largest group, in which Mehenkwetre superintends the counting of his cattle in this Noah's Ark of ancient Egypt

RUDYARD KIPLING who is given to saying the right thing at the right time, once remarked that archaeological excavations combined all the excitement of gold mining with an intellectual pursuit. This just describes it: archaeological treasure-troves are fascinating but likely to lead to disappointment, for the hand of the plunderer is often in evidence even though the perpetrator of the theft may be dead for a couple of thousand years. For sheer luck the Egyptian Expedition of the Metropolitan Museum of Art almost holds the record. By "luck" let it be understood that we do not mean aimless meandering over a given territory followed by a bonanza strike. The archaeologist is a man of science, who is keen on surface conditions, history and everything which goes to the making of a scientific Sherlock Holmes.

The museum has had a concession for a number of years on the west bank of the Nile at Thebes. After the war was over, excavations were begun under the direction of Mr. Herbert E. Winlock with an efficient scientific staff. At the beginning of the season of 1919-1920, a huge tomb of the Eleventh Dynasty was being "cleaned up" to get an adequate idea of its typography. It seemed that nothing worthy of special note was to be discovered; but it is the practice of all good archaeologists to clear thoroughly, so that everything can be mapped out with that painful and mathematical accuracy, so dear to the heart of the archaeologist. In this case patience brought a large reward.

The site of the find is weirdly impressive. Great buttressed cliffs of tawny limestone practically enclose a deep amphitheater a quarter of a mile in diameter. Here was situated the mortuary temple of the last kings of dynasty XI.; and high above around the rim of the depression are the black mouths of the tombs of the courtiers including that of Mehenkwetre, a chancellor and steward of the royal palace—one of the most powerful men in Egypt in B. C. 2,000. Mehenkwetre had chosen his site well and built a causeway up the side of the cliff at an angle of 20 degrees. This leads to a portico, corridors and burial chambers which had been duly rifled at some former period. Everything pointed to a dismal disappointment, but one day one of the men noticed that the chips of stone trickled from his hoe into a crack in the rock. One of the explorers came along at this juncture and struck a match to light up the darkness in the fissure. One glance was enough; a native carried a hastily scribbled note to the other members of the Expedition to come quickly and bring electric torches. The sun had set and the gloom of night so intense in Egypt had descended upon the cliffs, but when the archaeologists lay flat on the ground and shot a beam of light into the crack, one of the most startling sights that it was ever a digger's luck to see flashed before them. In the small, totally untouched chamber were dozens of dolls and other figures, brightly painted, and looking like a glorified Noah's Ark. The aperture was corded and sealed for the night and preparations were made to extract the last grain of knowledge out of this queer find. A room was cleared out in the house below, mirrors and reflectors were hunted up and for three days photographs were taken with the aid of daylight flashed along the corridor for one hundred feet by a mirror and a silver paper reflector. Fortunately, the rock held together long enough to get out the objects enclosed in the chamber. The room was not, as the explorers at first thought, a little burial chamber. In fact it was a secret room in which part of the tomb equipment of Mehenkwetre had been placed. A thousand years before his day it had been the custom for the tombs of the wealthy to contain such a chamber—called by the modern Arabs the "serdab"—in which the dead man's statue was walled up. Later it had been the custom to put beside the statue a few figures of servants at their daily tasks eternally preparing food and drink for the dead owner of the tomb. Gradually these servants had been multiplied and the statue of the man himself been made smaller until at last his figure had been reduced to the same scale as the servants. The latter were now grouped in model workshops or on boats, performing their tasks; and the master's statue had become a figure in the tableau, watching the work done for him. The spirits of the little model workmen and the spirits of the food they produced eternally, supplied the spirit of the little statue—the soul of the dead man. This idea was universal among the Egyptians of 2,000 B. C.; every one

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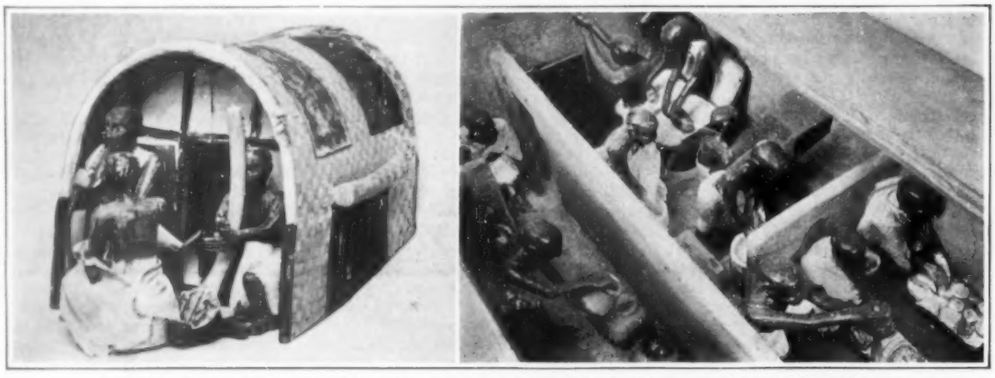


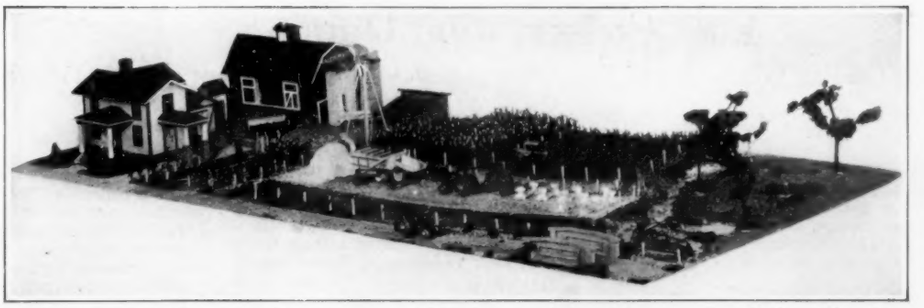
Left: **Mehenkwetre sits in front of his cabin and listens to the music of a singer and a harpist.** *Right:* **Brewing was not taboo in ancient Egypt. In fact they invented beer. Here brewing and baking are carried on under one roof**

Two more scenes from the life of a magnate of ancient Egypt

Seen through a hole in the rocks, a world of 4,000 years ago in brightly painted miniature, was revealed by the electric torch. A girl, still poising her basket of meats and stores, gazes stonily at the invaders of the tomb

Showing the Little to Sell the Big

APPEARING at most of the big tractor shows of the past few months has been a bit of interesting modeling. The scene depicts in perfect duplicate a model farm with all the up-to-date equipment that goes to make farming efficient. There are harvesting machines, tractors, silos, windmill and chicken house. Wheat and corn fields, together with a garden of growing vegetables, make the farm scene the more realistic. The good roads idea is also shown, as well as a concrete pavement extending over a babbling brook. A model bridge completes the exhibit. All farm machinery is modeled after the big machines. The miniature farm covers a space 4 by 8 feet and is realistically colored to make it attractive to all those who behold it.



Model farm and farming equipment employed by a tractor manufacturer as an aid in selling his product to farmers

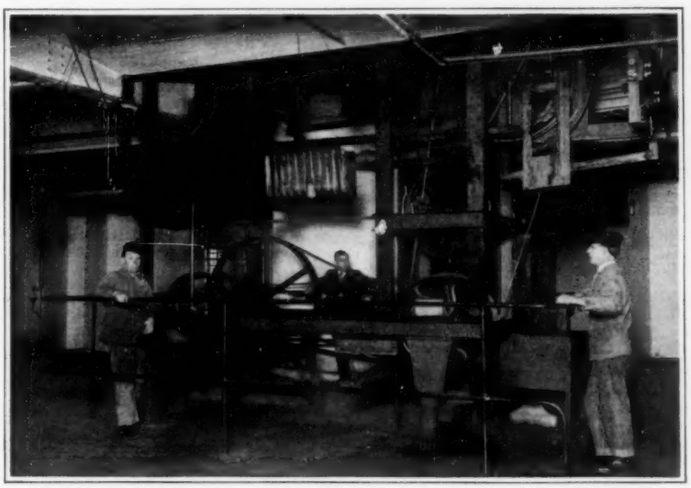
Washington's Rapid Transit Book Service for Legislators

YOUR Congressman, who perhaps with only half an hour's advance notice, is challenged to defend the high tariff on wool, finds a wealth of information handy, and telephones the Congressional Library for text-books on the subject. Are the books dispatched by a special messenger? Yes, but the errand-bearer in this instance is charged with electricity and the books encased in an electric basket, are conveyed from the Library to the Capitol through a tunnel, the trip being made in five minutes.

And the electric basket in all probability is not empty on its return engagement as doubtless the same Congressman or one of his colleagues has just finished with a book on the subject of irrigation in the West. Literally speaking, this "traveling mechanical library" is operative to the Capitol, Senate and House Office buildings. The attendant at the Library places the books in a leather covering, not dissimilar to a suit-case, drops the container in the electric carrier, touches an electric button, and, presto, the books are speeding on their way. Returning from the assignment, the carrier automatically dumps the books and containers in a spacious box designed for the purpose.

The mechanical arrangement is possible through a supply of power furnished by a motor in the basement of the Library, as depicted in the accompanying illustration. The tunnel through which the conveyor operates is 5 feet wide and 9 feet high, large enough to permit of the passage of a person should the electric apparatus become inoperative for any mechanical reason.

The baskets, made of iron, are 2½ feet long, 2 feet high and 5 inches wide, the front bars of iron being 3 inches apart. The books, after being encased in leather containers, are strapped in the basket. The "traveling library" can be stopped at its destination, but the apparatus is subject to the beck and call of the Library when the electric button is pressed.

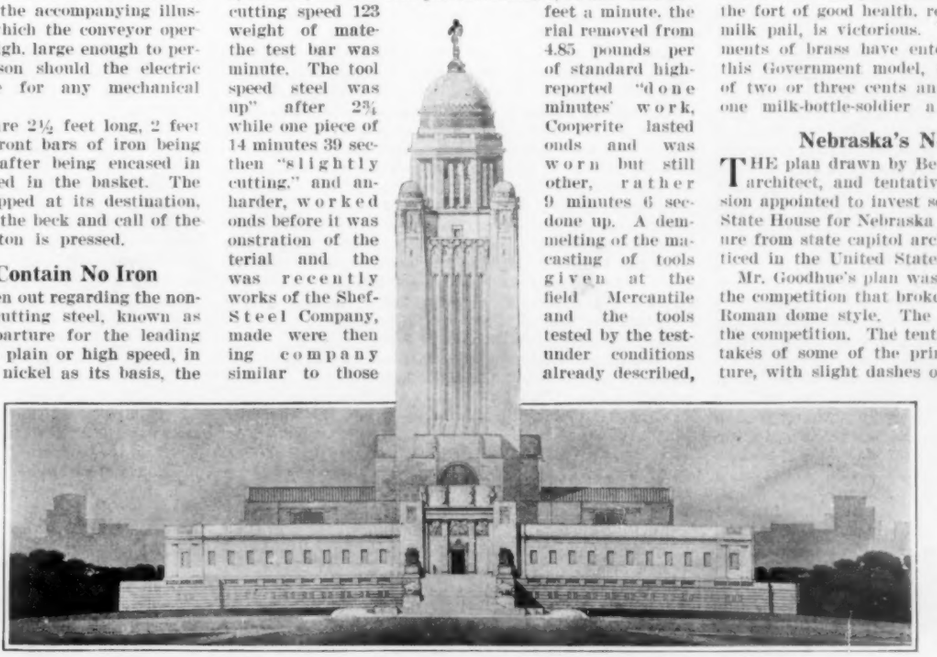


Machinery that operates the book-carrying basket that runs between the Library and Congress. The basket is behind the electric bulb in center

Cutting Tools Which Contain No Iron

SOME more data are now given out regarding the non-ferrous cutting tool for cutting steel, known as Cooperite. It is a signal departure for the leading material for cutting tools, both plain or high speed, in steel. This new material has nickel as its basis, the other components being tungsten, silicon, molybdenum and aluminum with a proportion up to 15 per cent of zirconium. During the war it was made in this country on a semi-commercial scale and used for turning shells, and a plant for its production and the manufacture of tools of all kinds is being erected at Kokomo, Indiana.

Turning tools made of Cooperite are cast and then ground to shape, without any forging or heat treatment. They are described as being exceedingly tough, with a fine silky fracture, and free from shrinkage and blowholes, and it is stated that they can be used for the bulk of engineering operations except those for which specially thin tools are required. In tests made at the establishment of the Sheffield Testing Company the alloy was put in competition, on lathe roughing, with the standard high speed steel used by that company, which is declared to be superior to the majority of Sheffield high-speed steels. In one series of tests, in which the tools were ¾ inch square, the depth of cut 3/16 inch, the traverse per revolution 1/16 inch and the cutting speed 123 feet a minute, the weight of material removed from the test bar was 4.85 pounds per minute. The tool of standard high-speed steel was reported "done up" after 2¾ minutes' work, while one piece of Cooperite lasted 14 minutes 39 seconds and was then "slightly worn but still cutting," and another, rather harder, worked 9 minutes 6 seconds before it was done up. A demonstration of the melting of the material and the casting of tools was recently given at the works of the Sheffield Steel Company, field Mercantile Company, and the tools made were then tested by the test-ing company under conditions similar to those already described, except that the cutting speed was 120 feet a minute. A Cooperite tool lasted 21 minutes 20 seconds, while one of the best high-speed steel broke down after 2 minutes 20 seconds.



Plan drawn by Bertram G. Goodhue of New York for the new capitol of Nebraska

The Battle for Health

THE power of milk to destroy the fortifications of ill health, is demonstrated by an animated model designed by K. E. Parks, dairy engineer of the Dairy Division, United States Department of Agriculture, for exhibition at the National Dairy Show in Chicago, recently. Supplementing milk posters, essays on products of the cow, milk dairies, and a health railway limited, this so-called "fort model" serves to stimulate drink-more-milk campaigns and impress the lesson that milk is the arch enemy of under-nourishment.

The idea of constructing such a mechanical device, requiring months of skilled effort, was brought to Washington by Miss M. Jessie Hoover, milk utilization specialist, who observed an amateur arrangement of a fifth-grade pupil in the Pittsburgh schools who had equipped two forts, representing ill and good health. Similarly, a Spokane boy last year built a health railway limited, thereby lending enthusiasm to a "drive" for increasing the consumption of products of the pail. Somewhat complicated, novel in effect, and yet the most pretentious thing of the kind designed is the model of the Dairy Division.

A miniature battle is waged against the forces of ill health, the milk bottle being victorious. Picturesque scenery, a winding river, an open road, and soldiers emerging from a clump of bushes are represented by realistic effects in the mechanical formation, the apparatus weighing about 250 pounds. It is operated by a motor of one-twenty-fifth of a horsepower, and tiny milk bottles typify soldiers who go "over the top." Five soldier-milk-bottles are operated along a conveyor, 4½ feet long, a wheel of 200 r.p.m. sending the soldier across the river at the other end of the conveyor.

At the further end of the tramway, a mat forms a backstop to keep the invading soldiers from bouncing, they dropping into a hopper to be re-conveyed to the starting point ready for another siege. As the soldiers emerge from the clump of trees a white flag at the other end of the conveyor is lowered, thereby signifying that the fort of good health, represented by products of the milk pail, is victorious. Wood, sheet iron, and fragments of brass have entered into the composition of this Government model, which is operated at a cost of two or three cents an hour. The mechanism fires one milk-bottle-soldier a minute.

Nebraska's New State Capitol

THE plan drawn by Bertram G. Goodhue, New York architect, and tentatively accepted by the commission appointed to invest seven million dollars in a new State House for Nebraska is a bold and striking departure from state capitol architecture as it has been practiced in the United States.

Mr. Goodhue's plan was one of two out of the ten in the competition that broke away from the conventional Roman dome style. The other plan did not figure in the competition. The tentatively accepted building partakes of some of the principles of Egyptian architecture, with slight dashes of Spanish and Mexican.

The striking feature of the design is the 400-foot tower, rising out of a great main building which has a base length of 400 feet. The tower is surmounted by a small dome to be covered with golden tiles, and being located in the prairie country it will be a landmark for many miles. The plan calls for a grouping of all necessary executive offices, including a great memorial hall, about four courts.

Fuel Conservation Opinions—I

What Leading Consumers of Fuel Have to Say About the Present and the Future

As Reported by Austin C. Lescarboura

THERE is no universal fuel. What is an excellent fuel in one locality proves a quite unsatisfactory fuel in another locality. Each industrial center has its own choice, based on cost and usage, so that in any discussion of the relative merits and disadvantages of fuels, we must not forget the element of place as well as time and general conditions.

Both coal and oil, Mr. Thomas A. Edison tells us, are employed in his plants at Orange, N. J. Where it is possible to use coal, he prefers that fuel to all others. Oil is objectionable, since the price varies so much over a period of years. Coal, says Mr. Edison, is the best fuel; there is very little variation in price or quality over a period of years; and judging from the immense deposits, there is no immediate danger of a serious shortage.

Why Many Consumers Prefer Coal

And what Mr. Edison says is typical of many other fuel consumers in the central and eastern United States. For instance, Mr. A. K. Birch, of the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., states that the power plant of their West Allis Works uses coal because it offers the most certain supply and is readily stored in large quantities without great expense. Coal, since it is relatively cheap, can be stored in large quantities without heavy expense, and is obtainable from a great many districts.

Mr. Stuart Cooper, of the Charleston Consolidated Railway & Lighting Company of Charleston, S. C., is another advocate of coal, and may be considered as spokesman for our South Atlantic States. Coal is the least expensive, states Mr. Cooper, although he adds that this depends upon the location. In his locality coal meets the requirements of his organization at the least cost.

Of the same opinion is Mr. P. W. Ripple, Chief Engineer of Power and Equipment of the Connecticut Company, which operates an extensive system of trolley lines throughout the State of Connecticut. His organization, states Mr. Ripple, uses coal because of its cheapness in that particular territory. However, Mr. Ripple is emphatic in pointing out that the best fuel available today depends entirely on locality. It may be coal in one place; oil in another; water in another; and so on.

Turning to railroads, we again find that the locality determines the fuel. Most of the Eastern railroads employ bituminous coal for locomotives and power plant fuel because of its availability, and because of the low cost and simple design of locomotives and power plants for its use. The Illinois Central Railroad, speaking through its Vice President, holds this view, and states that it consumes such bituminous coal as is produced by mines on or adjacent to its right-of-way. In the same general vein speaks the New York, New Haven and Hartford, through Mr. W. D. Bean, Mechanical Assistant to the President. This railroad, which covers the New England territory, employs bituminous and semi-bituminous coal, as well as coke; the first two fuels are employed for locomotive and stationary power plants, and the third for stationary power plants, where smoke and dust are not desirable. The best fuel available for this railroad, we are told by Mr. Bean, is coal preferably in the shape of high grade bituminous and semi-bituminous coals from Pennsylvania. This is so for economic reasons, taking into account the heating value of the coal and its cost ready for use on their system.

The New York Central Lines, according to Mr. A. T. Hardin, Vice President, also use bituminous coal for engine fuel, except at one or two points where, for the purpose of preventing smoke, it is necessary to use anthracite, and also in some of the forest regions where State laws require the use of oil. Bituminous coal under present conditions is the most economical fuel for general railroad use, states Mr. Hardin; and it is the only steam-raising fuel which is today available in sufficient quantities to carry on transportation and meet the requirements of the industries of the country.

Another railroad that consumes bituminous coal is the Chicago, Burlington & Quincy. Bituminous coals from Illinois, Iowa, Missouri, Wyoming and Colorado; sub-bituminous coals from Colorado and Wyoming; and fuel oil from Wyoming, are utilized, according to Vice President E. P. Bracken. The coals referred to are favored because they are produced on the railroad's own line and are the most economical and readily available fuels. The use of fuel oil was started to help the oil refineries dispose of their residuum oil. However, the improvement in cracking processes will more than likely result in a decreasing use and eventual abandonment of residuum oil as a locomotive fuel. For their purpose, states Mr. Bracken, coal is the most suitable fuel, because the railroad serves a large coal-producing territory.

Fuel Oil and Its Advocates

Yet the use of fuel oil is steadily increasing. Some concerns are making provisions to consume coal or oil at will, so as to take advantage of market fluctuations in either fuel. Thus the various plants of the U. S. Industrial Alcohol Company are equipped to handle either of these fuel materials. The reason given is that at times it is easier or cheaper to get one or the other, depending on the time and location. The best fuel available today, states this company, depends on the operation for which the fuel is used, the location, labor conditions, and railroad facilities. The choice between the use of fuel or coal in most cases is purely an economic one; but oil is, of course, easier to handle and to regulate, and requires less labor. But when the labor involved in the utilization of coal is figured in as part of the cost of coal, the question is purely an economic one.

It is in southern California that fuel oil is widely employed. One large user of this fuel is the Southern California Edison Company of Los Angeles. This power company is using crude oil because it has been the most economical and, by reason of its local production, the most readily obtainable fuel available to southern California consumers. According to Mr. R. H. Ballard, Vice President and General Manager of that company, the increase in the price of crude oil in California within the past four or five years from 50 cents to $2.00 a barrel, prohibits its continued use in large quantities as a fuel for the generation of electric power. At any rate, states Mr. Ballard, as a fuel for ship propulsion crude oil has a superior use for which its limited supply should be conserved. Furthermore, the best fuel available today for the generation of electric power is "white coal"—the inexhaustible hydro-electric power of the mountain streams—of which California is fortunate in possessing 15.6 per cent of the total potential water power in the United States.

Down in Louisiana the New Orleans Railway & Light Company, according to its Superintendent of Power, Mr. Frank Frost, has three steam-generating stations, two of which are old and inefficient and are used only in case of emergency. In the main station, this company burns both coal and fuel oil. Just now, coal is slightly less expensive than the fuel oil equivalent; but this company has a two-story boiler room the second story of which is so constructed that it can only burn fuel oil under boilers on that floor.

Fuel oil is steadily coming into its own for maritime purposes. One by one the largest liners are being converted into oil burners, although it appears that there are very definite limitations to the size and kind of ship on which oil-firing boilers can be employed to the best advantage. Thus most of the large steamship companies use either fuel oil or coal on their ships, depending on many factors in each case.

With the Users of Natural Gas

In certain sections of the country natural gas is available for heating, illumination, and power purposes. Thus in California, there are districts in which natural gas is available, and it ranks with fuel oil as the best fuel obtainable in the Southwest. In the Middle West natural gas is available in many cities. Typical of the use to which this fuel is put is that of The Union Gas & Electric Company of Cincinnati, Ohio. Natural gas from West Virginian fields is being employed by that company, according to its Mr. DeForest, whenever available, which is throughout the year except during winter months when the supply is limited to domestic needs, all the industrial users being cut off. During the winter the fuel of that company consists mainly of Logan County semi-bituminous coal running about 13,000 B. T. U. per pound, and a lesser amount of other coals picked up on the market. The main supply of that company's coal is from its own mine. Mr. DeForest states that coal, either powdered or gasified after taking out the by-products, is the best fuel; oil, using the lower grades, is the second best; and natural gas is the third best, because as a rule it is too valuable to be consumed for power purposes.

What About Water Power?

When asked regarding the future of water power in the United States, Mr. Edison stated that he believed that in years to come coal would rise in price and this would insure the utilization of all the water powers commercially available, based on the standard of the price of coal then in force. Indeed, the price of coal, says Mr. Edison, sets the value of the water power.

The total available water power of the United States would, if completely utilized, provide only a minor part of the power now produced by the burning of fuel, we are reminded by Mr. Edward W. Jones of the Laclede-Christy Clay Products Company of St. Louis. More complete development of our hydraulic power resources is desirable since it would lower power costs in some localities, reduce the fuel transportation problem and decrease our annual consumption of fuel. Water power cannot, however, be expected to provide more than a small contribution toward answering our big fuel problems.

The future of water power in the United States, especially in California, is quite promising, according to Mr. Ballard of the Southern California Edison Company. The passage of the Federal Water Power Bill, as well as the scarcity and increasing price of fuel, has given a great stimulus to the development of hydro-electric power in the West. The lower cost of water power in comparison with power produced by steam is causing a gradual industrial movement westward to the centers of hydroelectric power, according to this authority. This movement has and will continue to quicken the need for the development of the water power resources of the West. The Southern California Edison Company alone has a hydro-electric power development program which will bring into production approximately 4,000,000 horsepower. Of this amount, 1,000,000 horsepower will be developed on the San Joaquin River, known as the Big Creek Project, and the remaining 3,000,000 horsepower will be produced along the Colorado both above and below the Grand Canyon.

Conservative estimates indicate that the normal growth of California, continues Mr. Ballard, combined with the western movement and the electrification of certain railroads, will absorb this immense amount of power by 1945. The consummation of this complete program will require an investment of approximately $850,000,000 for the construction of the power plants, transmission and distribution systems.

Water power becomes increasingly valuable with the character of its development; that is to say, the ideal is to maintain a uniform flow of water throughout the year, states an official of the American Engineering Company of Philadelphia, Pa. The more money that has been spent for storage of water and for stand-by steam plant service during annual periods of low water, the less valuable the water power. The principal element of cost in the water power plant is an investment

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THE basis of all industry is fuel—fuel in any form, whether it be coal, peat, lignite, oil, natural gas, wood, coke, or even water power. For without fuel there is no turning of the wheels of industry, and everything must come to a standstill. Hence there is good reason why fuel conservation should be an oft-mentioned subject in the columns of this journal, and why we asked over seventy-five leading users of fuel for an opinion as to present conditions and future developments. The large mass of information which these leading fuel consumers gave us could not be digested and boiled down for presentation in a single issue, hence the first part appears this week and is to be followed by the second part in an early issue.—THE EDITOR.

Cold Vulcanization of Rubber

A New English Process with Many Advantages Over the Old Ones

By F. Rowlinson

IN English scientist of some standing, Mr. Peachey, the Lecturer in Chemical Technology at Manchester University, has announced a new process of rubber vulcanization, which it is claimed will revolutionize many branches of rubber manufacture. By the use of two gases, both cheaply and readily obtainable, he has perfected a scheme of cold vulcanization of rubber which combines the ready application of the present "cold" process with the fine quality of the hot process.

The mechanism and chemical changes involved in the new process can better be understood when the nature of the rubber and the processes of its manufacture are considered. Rubber is the latex of a species of tropical tree. The nature of this latex and the part it plays in the life of the plant is not clearly understood. It is entirely distinct from the sap which by its circulation gives life to the plant; indeed, the tree seems to suffer no harm by its removal. The latex is tapped from the tree by incisions made in the bark, and is collected—a thick viscid liquid of varying color. After exposure to the air, the latex undergoes a spontaneous and remarkable change, particularly if heat is supplied. From a liquid it slowly thickens into a semisolid mass, still retaining some of the stickiness which characterizes the liquid. The change from raw latex to caoutchouc is hastened by working the mass, and in its later stages by curing over fires. At the same time, leaves, stalks, small stones and other foreign matter are as far as possible removed. The cured caoutchouc is a solid mass of varying color according to its source and treatment. On application of even a moderate amount of heat it rapidly becomes soft and viscous, recovering its solidity at low temperatures. A high temperature destroys and decomposes the mass into a sticky liquid which does not regain its properties on cooling. The nature of the change from the raw latex to crude caoutchouc is thought to be partially an oxidation effect, but chiefly to be due to molecular condensation or polymerization. An artificial synthetic organic compound, isoprene, exhibits similar properties, and has been called artificial rubber. Its manufacture is, however, prohibitive in cost.

The crude caoutchouc is further purified mechanically by working between knives and rolls to insure homogeneity and freedom from foreign matter. The purified caoutchouc is, however, of little use in the arts and sciences. Though possessed of a slight elasticity at ordinary temperatures, it becomes plastic and soft at quite moderate temperatures, and further treatment is necessary. This is known as vulcanization.

In 1839 Charles Goodyear, of New Haven, discovered that rubber (or caoutchouc) when masticated with finely-divided sulfur at a fairly high temperature, undergoes a remarkable change. The sulfur combines with the rubber and the vulcanized mass is found to retain its elasticity to quite high temperatures besides showing a notable increase in tensile strength. The new product found a speedy application in industry, where its elasticity, freedom from corrosion and wet-resisting properties, made it a valuable material.

In 1846 Parkes made known his cold vulcanization process. This consisted in the use of sulfur chloride in solution in carbon disulfide. Rubber goods steeped in this solution became vulcanized in the cold; better still, articles were suspended in an atmosphere of sulfur chloride gas. By this means, textile fabrics having first been impregnated with rubber either by rolling it into their pores, or by steeping them in a solution of rubber and allowing the solvent to evaporate, the rubber treated article could then be cold vulcanized by treatment with the sulfur chloride. The Parkes process made possible such things as the mackintosh and other rubber fabrics, rubber shoes, etc. Cold vulcanized rubber is scarcely as high in its qualities as hot vulcanized but the convenience of the process outweighs this objection for many uses. Improvements due to various inventors were afterward made in both processes, notably in the hot process by the incorporation in the mass of catalytic agents such as litharge, magnesia, or antimony sulfide. These either promoted much quicker vulcanization or reduced the temperature required; a small proportion only was required as a rule to give the effect. Neutral substances such as barytes, zinc white, etc., may be used to load the vulcanized rubber, and pigments may be added to give color. Vulcanized rubber attains its maximum elasticity when it contains from 2 to 2.5 per cent of sulfur. Over-vulcanized rubber becomes hard and inelastic. It is known as ebonite or vulcanite and is the familiar substance of which fountain pens, etc., are manufactured.

This summarizes the state of the rubber industry at present. The discovery of a new process of vulcanization combining the virtues of both hot and cold processes, with some of its own, promises to cause a revolution of methods. The basis of the new process is common knowledge to every chemist. When the two gases, sulfur dioxide and sulfuretted hydrogen, are brought together, dense clouds of sulfur, in a very fine state of division, are formed. Both gases are very cheap and easily obtained—in contrast to sulfur chloride and carbon disulfide, which are expensive and objectionable in use. Now if raw caoutchouc be masticated in a closed machine, and sulfur dioxide gas be pumped in, the rubber will absorb a certain amount in its pores. If now sulfuretted hydrogen be admitted to the machine, an immediate precipitation of sulfur in the finest state of division, takes place *in the very mass* of the rubber. Vulcanization takes place at ordinary temperatures; and by alternately admitting the gases, any degree of vulcanization may be attained. Further, to secure vulcanization by ordinary processes, it is necessary to have some excess sulfur, which is detrimental to the properties of the finished material. The new process leaves no excess of sulfur. Owing to the fact that the process is carried on in the *mass* of the rubber *at ordinary temperatures* it is practicable to in-

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Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

How To Get Back To Normal

To the Editor of the SCIENTIFIC AMERICAN:

This is the year of liquidation and readjustment in business. The present condition can be best expressed as follows:

No selling, no buying;
No buying, no making;
No making, *then what?*

Falling sales, unemployment, idle plants, decreased production, high costs, and heavy losses, are elements in the present situation, and can only result in one thing—depression and business stagnation—unless constructive steps are taken to get back to normal quickly.

There should be plenty of business ahead. Our children need schools; our families need homes to live in; our cities require new public buildings; our automobiles, trucks and farmers need roads; our railroads need repairs and new tracks, roadbeds and equipment; our public utilities need betterments and replacements; our furnaces and stoves require fuel; our people need shoes and clothing. In addition to all of this, the world needs food.

Here is a constructive program based on years of experience in industry:

1. Determine normal capacity of machines, working places, departments and plants, in hours. This may be 75 to 85 per cent of your possible capacity.

2. Standardize overheads according to departments, with due consideration to reductions in same, determining what these overhead rates would be for your normal capacity.

3. Determine from estimates, records of past performances, by conferences or by observations, what would be fair and attainable production standards per hour for your various operations, using your normal capacity as a basis. Do this for the reason that productivity (relative amount produced per hour), is the gage of economy and efficiency in manufacturing.

4. This will enable you to determine various combinations of the standard quantities of the various products you can make.

5. Using current prices for labor and material, and your standardized overhead rates, the cost of these products, at normal capacity can be determined.

6. A fair and reasonable profit added to costs—or using costs for a time, if you have to—will mean prices which will bring business, because greatest volume of work goes to that concern whose prices reflect normal operating conditions.

7. Now call in some of your best workers as representatives of their fellow workmen, and outline to them what your present conditions are and what you want to do, explaining the above points, especially number 3, as they relate to unemployment, reduction in wages or hours, and company losses.

8. Place these plans before your banks, as a basis for credits and financial help.

9. At the same time get your sales and advertising campaigns tuned up with the above, giving due consideration to time payments, discounts and the like.

10. Charge the differences between actual and standard overhead costs into an adjustment account for the time being, which will decrease as you approach normal capacity, and which will cease when you reach normal. This loss will be much less for the coming year than it would otherwise be as plants are now operating. As you go above normal and reach possible productions, this loss would be offset in whole or in part by credits to the adjustment account. The balance, loss or gain, at the end of the year, would be carried into profit and loss.

The above is not mere theory. The steps have been tried and proved out and are practical and workable. They have been used by plants before the war and since the war.

Anticipating normal conditions will bring normal conditions more quickly.

C. E. KNOEPPEL.

The Einstein Contest and the Readers

To the Editor of the SCIENTIFIC AMERICAN:

As an interested bystander in the recent contest for the Einstein Essay Prize, I wish to point out two utterly false generalizations on matters pertaining to philosophy in the composite third essay published in your columns. Imagine my surprise when stumbling in the opening paragraph upon Auguste Comte's (1798-1857) thoroughly artificial genesis of human knowledge, long ago discredited. I mean the assertion that human knowledge has passed progressively through three stages, the theological, the metaphysical, the scientific. The positivism of Comte does indeed survive in this crude form in innumerable school texts, but I did not look for this sort of thing in a supposedly original contribution to the Einstein literature.

The assertion that "the ancient Greek philosophers believed that they could tap sources of knowledge pure and absolute about the nature of time and space by sitting down in a chair and reasoning about them," etc., does indeed have the ear-marks of originality, if ignorance may be called original. Shades of Aristotle and Zeller!

J. J. E. FREDERICK, Ph.D.

Pomeroy, Wash.

Time, Space—and Motion

To the Editor of the SCIENTIFIC AMERICAN:

I am a reader of your magazine and am interested in the "Einstein" articles. In the SCIENTIFIC AMERICAN of February 19, 1921, under the heading, "The New Concepts of Time and Space," I read, "But did you ever observe anything suggesting the presence of time in the absence of space or vice versa?" While this is true it is also true of all creation—nothing could exist without space to exist in. But did you ever observe anything suggesting presence of time in the absence of motion? Time is the product of motion.

Suppose something to go wrong with the force behind all motion and that all motion ceased (including growth, waste and repair, molecular, atomic action and every motion known or unknown) where then would we find a suggestion of time? And again suppose all things to move in parallel lines at the same velocity where then would we find time? Conclusion—time is the product of two or more motions either of different directions or of different velocities. While time cannot exist without space, space can exist without time, but motion cannot exist without time or time without motion.

LEWIS S. HOFLEY.

East Hampton, Conn.

Machine-Made Window Glass

How the Great Sheets of This Difficult Material Are Made and Handled

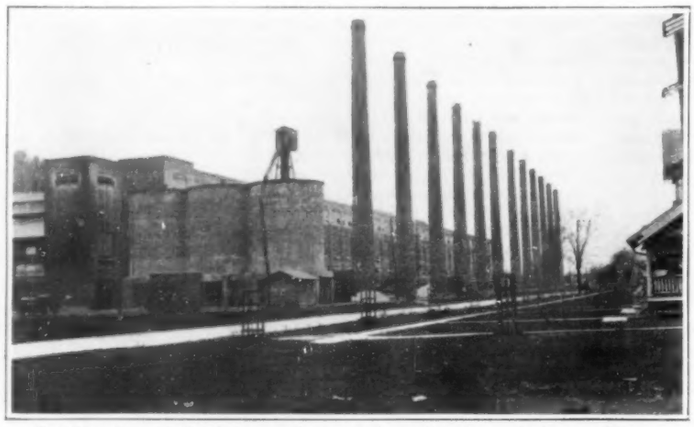
By Robert G. Skerrett

IN the manufacture of glass generally, the labor charge constitutes the largest single item of expense. This fact has inspired the inventor to evolve various mechanical agencies designed to reduce manual work as far as practicable; and it is noteworthy that a good deal of success has rewarded these efforts. Probably nothing in this direction has been more brilliant from an engineering standpoint than what has been done thus to cheapen and to amplify the production of window glass. The departures from the art of the hand-blown method properly divide themselves into two classes; and the present purpose is to treat of that one which fundamentally is the more revolutionary.

Nearly four decades ago an ingenious man by the name of Clarke essayed to produce sheet glass by mechanical means, and his example started others along the same path only to drop by the wayside because of seemingly insurmountable obstacles of one sort or another. But about 1908 one creative genius, Irving W. Colburn, of Franklin, Pa., profiting by the experience of his predecessors, brought out an apparatus for the manufacture of window glass that possessed features of especial promise. With it, it was practicable to draw long sheets of glass of considerable width and of various desired thicknesses. Even so, there was much to be done to fit the machine for industrial service; and after years of costly experimenting, in which several men took a part, the patent rights were sold for something like $15,000. Subsequently, control of the invention was secured by E. D. Libbey and Michael J. Owens, both of whom have figured conspicuously in modernizing the making of glass.

It was not, however, until S. B. Henshaw, acting for Messrs. Libbey and Owens, took over the problem and rounded out the whole process that Colburn's original conception was pronounced ready for application on an imposing scale. As a result, there is today at Charleston, West Virginia, a magnificent plant of many buildings, and there are installed 12 automatic sheet-glass drawing apparatus capable of turning out an immense amount of window glass in the course of a year. The procedure is a continuous one; and as long as a machine is active it produces glass of a prescribed width and thickness hour in and hour out.

Some idea of the rapidity of operation can be gathered from the fact that a machine will deliver a sheet 5 feet wide at a rate ranging from 24 inches to 100 inches in length every sixty seconds. The thickness determines this figure. That is to say, a sheet 1/24 of an inch in thickness comes over the roll at a speed of 8⅓ feet per minute, while glass ¼ of an inch thick is made at the rate of 2 feet a minute. The sheet goes right from the roll into the lehr, or annealing furnace, where, after a journey of 200 feet in a gradually lowering temperature, it passes out to a belt conveyor. There, the edges are trimmed automatically and the glass is cut crosswise into specified lengths. Up to this point every operation is performed mechanically.



Outside view of the factory where window glass is made by machinery

To appreciate what all of this means, let us go back to the very start of the work and follow it through from the raw materials to the stage just described. The batch for window glass is composed of sand, salt cake, and lime, with a small amount of powdered coal or charcoal. In some instances soda ash is substituted for the salt cake. These ingredients, at Charleston, are severally scooped up mechanically from the railway cars in which they arrive at the plant and are deposited into elevated concrete bins. From these storage tanks, the sand, salt cake, lime, etc., flow by gravity into an electrically-driven mixer, which stops successively under each bin to receive the required amount of the different raw materials. The batch, so measured and prepared next goes into a hopper which feeds a belt conveyor, and the latter, in its turn, carries the mixture to the chutes reaching directly to the receiving ends of the melting tanks. There, an attendant, by raising a lever, lets the stuff drop into the tank to replace the molten glass drawn off at the farther end of this furnace. A single man can thus take care of six tanks, while another operative reverses the flames of burning gas—issuing alternately from one side of the furnace to the other—of the same group of tanks. This reversal is necessary in order to maintain more nearly uniform the heat of the furnace structure, which is designed to work on the regenerative principle.

No small part of the success of the Charleston plant is due to the way in which the melting tanks are built of blocks of refractory materials and the furnace walls are cooled by circulating water and air to insure relatively long life. These tanks, exposed to a temperature of from 2,600 to 2,800 degrees Fahrenheit, have been run continually for stretches of eighteen months without calling for troublesome repairs or their shutting down. Each tank has a 30-pot capacity holding many tons of molten glass, and the daily yield of glass is equal to the production of 44 blowers in a so-called hand-working establishment. The molten glass that is formed into sheets is withdrawn from the furnace by a simple yet, withal, an amazingly effective attachment which, in principle, is akin to the gathering rod or "punty" of the ordinary glass blower.

This is one of the features of the machine which has required a protracted period of research; and in its present form is nothing more elaborate than a heavy iron rod, suspended horizontally by a number of copper straps, which can be raised and lowered. This rod, technically termed a "bait," is dropped into the molten glass within the tank, where it cools the glass immediately in touch with it. This induces adhesion, and when the rod is lifted electrically it pulls with it a trailing plastic mass of incandescent glass about two inches thick and as wide as the bar is long. After mounting a distance of 30 inches the glowing sheet, extending upward from the tank surface and adhering to the bait, is drawn over a bending roll and led thence on to a flattening table. This table is really a continuous belt made up of a series of closely spaced metal slats, and is about 6 feet long and 72 inches wide. The belt spans the gap between the furnace and the lehr, and moves with the sheet of glass. In order to keep

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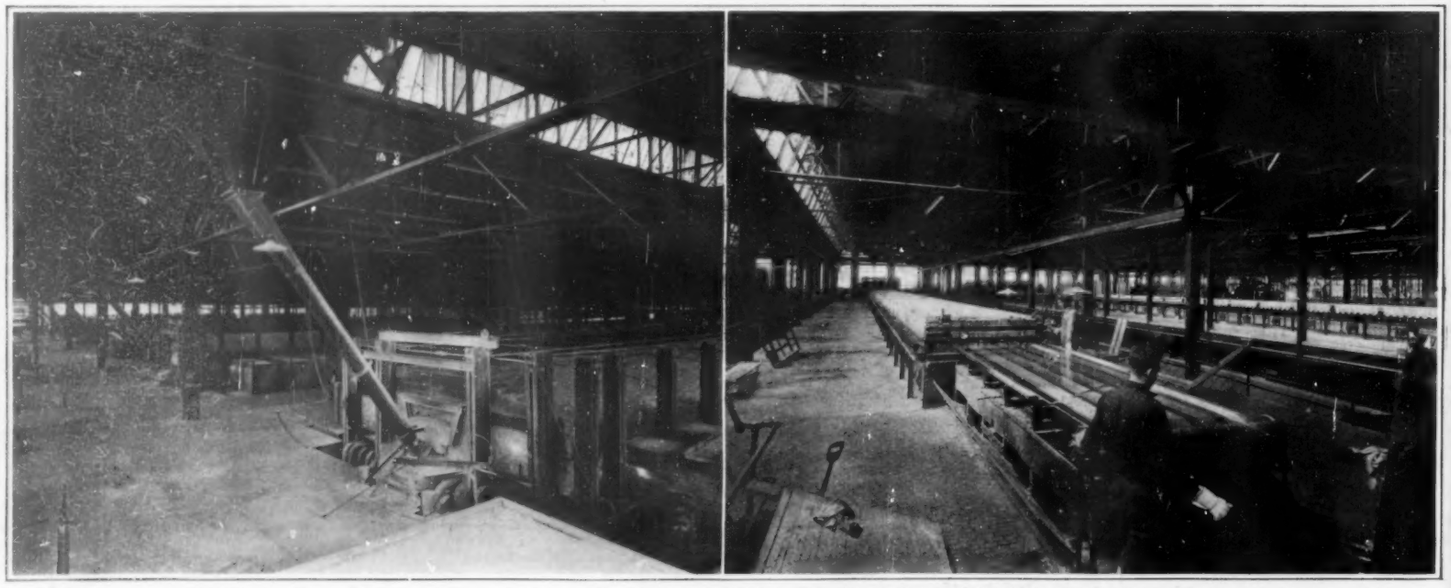


Left: The feeding end of a battery of melting furnaces or tanks, showing the chutes by which the batch is intermittently discharged into the tanks to make up for the molten glass removed by the glass-drawing machines. *Right:* The exit end of the lehr of one of the glass-drawing machines. Before leaving the belt conveyor the glass is cut into sheets of large size; the market sizes are later cut from these by hand

Rolling window glass in sheets by a continuous process

The Italian battleship "Leonardo da Vinci," sunk during the war, lay upside down, with guns and turrets in the mud. These were cut away, and by filling the side tanks with water the ship was rolled over as here shown

A great feat of ship salvage: Righting the Italian dreadnaught "Leonardo da Vinci" by rolling it over

A Great Feat of Ship Salvage

IT will be remembered that during the war, one of the finest and most modern of the Italian dreadnaughts, the "Leonardo da Vinci," was sunk in harbor. Before her final disappearance, the great ship of 22,000 tons' displacement turned turtle; and when the divers investigated, they found that she was lying deck down upon the bottom. Here, indeed, was a problem, inasmuch as the five heavy barbettes and their turrets, with the 12-inch guns, of which there were thirteen, were buried in the mud. These heavy weights acted is a sort of enormous deep underhung ballast to prevent the lifting and righting of the ship.

We have already in a previous issue described the operations of getting the hull to the surface and in dry dock. First, the divers cut away the five turrets with their thirteen guns, lightening the ship to that extent. The hull was then made watertight, raised bottom up, floated into dry dock and unwatered there, the superincumbent mass being carried upon special supports of cribbing and heavy timber struts judiciously disposed under the whole deck of the ship so as to properly receive the great concentrated loads which are peculiar to battleship construction. After additional deck weights had been removed, the whole hull was made thoroughly watertight, the dock was flooded and the ship, still bottom up, was floated out into deep water. The task remaining was to roll the ship over into its normal position. This was done by gradually flooding the side ballast tanks and submerging one side of the ship deeper and deeper until, by flooding the bottom tanks adjoining the already-flooded side tanks, it was possible to bring a righting moment into effect, which pulled the ship entirely over until she floated, deck up, as shown in our illustration.

An Improved Gas Mask for the Navy

WE show here a photograph of a type of gas mask used in the Navy during the later days of the war which is not generally familiar to the public. Most of us know the gas mask which carries a container, shaped like a tin can, over the mouth, strapped on around the head. This new type is in several ways superior to the other.

It consists of a rubberized canvas face mask, which must, of course, fit closely around the face to be effective in keeping out poisonous gases. To this is attached a headpiece made of tin which supports a tin canister, held in place by leather straps; the canister, in turn, connects with the face mask by two tubes which enter the mask back of the glass windows for the eyes. At the back of the container is an inlet for the air, which passes through the chemically-treated filler in the container, down through the tubes to the opening between the face and the mask and is inhaled by the wearer. Air is exhaled through slits in the flat, hexagonal rubber flap at the top of the nose-piece.

These openings stay closed during inhalation. The whole apparatus weighs only about 2¾ pounds, and is so simple that it is very easily adjusted; and it is so compact and fits so well that the danger of its being knocked or shot off is not nearly so great as with the old style mask. The container, which acts as a protection for the top of the head, may be removed easily if it should be damaged or when the chemicals used in treating the filler have deteriorated, and a new container substituted; in fact, containers which have

Improved Navy gas mask with detachable container. Each man has several containers treated to counteract different poison gases

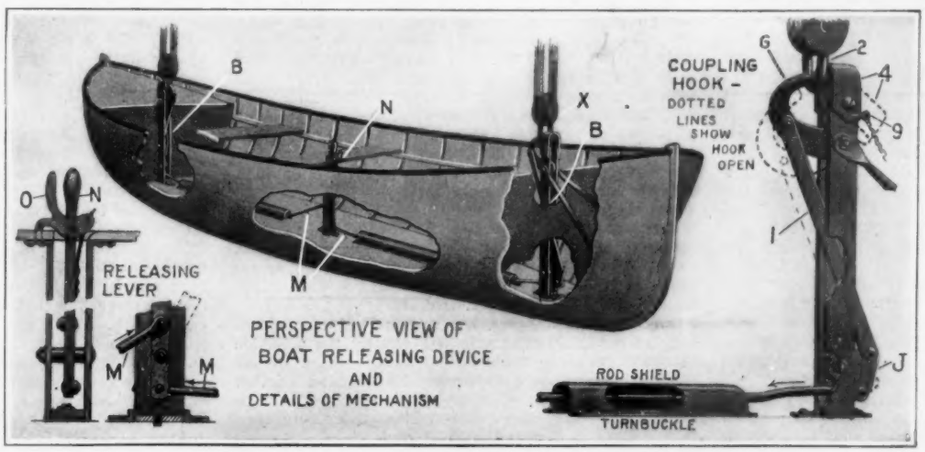
fillers of different chemical substances are adjusted to the mask to meet the various gases to which the wearer will be exposed. For example, sailors who are stationed high on the masts of our warships where clouds of smoke pour out of the funnels, wear containers treated to neutralize the effects of carbon monoxide gas, since smoke is composed largely of carbon monoxide, a deadly poison; and chemical processes have been worked out for the treatment of fillers to be used to counteract the action of other poisonous gases which are used most commonly on the battlefield. The mask we describe will counteract poisonous gases for as long a period as six hours. The older type can be worn for two and a half or three hours. This difference in time is due in part to the larger container used on the new mask.

Ship's Boat Launching Gear

IT is a curious fact that in the endeavor to make the steamship safe against the accidents of the sea, the naval architect has failed to give adequate attention to the provisions for saving the passengers or crew when a ship is sunk by accident. Proof of this was seen in the loss of the "Titanic."

The lifeboat launching or releasing gear which we illustrate, has been tested by the Steamboat Inspection Service of the Department of Commerce, which expresses the opinion that it possesses considerable merit as a boat disengaging apparatus, and recommends that if its parts which are subject to friction be constructed or lined with non-corrosive metal, it be approved for use on steam vessels under the jurisdiction of the Steamboat Service. The report speaks approvingly of the releasing gear because of its positive action, due to its rigid releasing agencies in the form of steel rods operated from the releasing lever in the center of the boat.

The device as shown consists of two upright standards, one at each end of the boat. At the upper end of the standard is a releasing hook (G), which engages a U-bolt (2) of the hoisting tackle. Each hook is coupled by means of a link-arm (I), to a bellcrank lever (J), which is held in the bottom of the standard (B). Each bellcrank lever is coupled by a connecting rod, (M), with the actuating lever, (N), in the center of the boat. This lever is locked in its normal position when the boat is being raised or lowered by a catch (O), at the upper end of the lever, which engages the boat's thwart in which the lever is carried. When the boat has been lowered to the water, the operator grasps the lever (N), thereby releasing the catch (O), and as the lever is swung over the two connecting rods (MM) act through the bellcrank levers (J) and the connecting rods (I) to pull the releasing hook down into the position shown by dotted lines in our illustration, thereby quickly and simultaneously releasing the whole of the hoisting gear. As a safety device to be used in northern climates, where the releasing gear may be clogged by ice, the U-shaped keepers (4), which are engaged by the hooks, are pivotally connected to the top of the vertical standards which carry the gear. To release these a split pin (9) is pulled out and the blow of a hammer suffices to knock the keeper clear of the hook as shown by the dotted lines. The construction is simple, rugged and positive in its action; conditions which are fundamentally necessary in a reliable boat-releasing device. The design worked out and patented by Mr. John A. McNabb, a marine engineer of Bayonne, N. J.



A new type of boat-releasing gear, approved by the Steamboat Inspection Service

The Heavens in May, 1921

The Chief News of the Month Afforded by Comets and Attendant Meteors

By Professor Henry Norris Russell, Ph.D.

TWO comets are now in sight—perhaps three, as the one discovered independently by Taylor and Skjellerup last December may still be visible in large telescopes. The next in order of discovery was first detected by Reid at Cape Town on March 13th, before the preceding article of this series was written, but while the writer was at sea. At this time the comet was in Capricornus, just south of the ecliptic, and 18° south of the equator. It moved steadily northward, and by this time is well above the equator, and much brighter. Elements of the orbit, computed independently at the Yerkes Observatory and the University of California, agree closely. The comet is moving in a retrograde orbit, inclined about 45° to the plane of the ecliptic, and had just passed its ascending node when discovered. It was then about 130 million miles from the sun, and 160 million from the earth, and rapidly approaching both. It will come to perihelion on May 9th or 10th, according to the two calculations, at almost exactly the earth's distance from the sun, but more than 40 million miles north of the plane of the ecliptic. Its closest approach to the earth will occur about the beginning of May, at a distance of roughly 50 million miles. Since the comet and the earth are going about the sun in opposite directions they will pass one another swiftly, and their mutual distance will increase to a hundred million miles shortly after the middle of the month. At brightest the comet will probably be a little above the sixth magnitude—just visible to the naked eye, and easily so in a field glass. Its rapid motion makes extension of even rough prediction difficult, the published ephemeris running out on April 28th. At that time it will be about half way between Alpha Cygni and Alpha Cephei, and moving almost due northward. It will pass near the latter star, and Beta Cephei, come within a few degrees of the Pole-star (on the side toward Cassiopeia) on about the second or third of May, and will then pass on toward the head of Ursa Major. No information regarding the physical appearance is at hand, but it is practically certain from the character of its orbit and its brightness that the comet cannot be of short period.

The most recent discovery is of an "expected" comet, and one of unusual interest—the periodic comet of Pons and Winnecke. This was first seen by Pons in 1819, but though the observations then secured showed it to be of short period, it was lost again until 1858, when Winnecke rediscovered it. Since then it has been seen in 1869, 1875, 1886, 1892, 1898, 1909, and 1915—its period being a little more than five and a half years. It is a member of Jupiter's family of comets and at various times it has passed close to the great planet, so that its orbit has been considerably changed by the perturbations. Since 1819 the period has increased by three months, the inclination from less than 11° to more than 19°, and the perihelion distance from 70 to 94 million miles. The last of these changes is of great interest, for it brings the comet's orbit very close to that of the earth. A century ago it passed more than 20 million miles inside our own track, but in 1905 it came within three million miles (inside again), while this year it will actually pass outside the earth's orbit, at a distance of a million miles or so.

The exact date of the comet's return had been uncertain, for it passed close to Jupiter in 1918, and the resulting perturbations of the orbit have not yet been computed. The region of the sky in which to watch for it was, however, pretty closely assignable, and, on April 10th of this year, it was detected by Professor Barnard on a photograph made in the search for it. At that time it was in the constellation Corona Borealis, in 15h. 55m. R. A., 37° north declination, and was moving northeasterly at the rate of 50 minutes of arc per day. It was of the twelfth magnitude, and therefore invisible except in large telescopes.

In a case like this, when the track which a comet is following is fairly well known, although its position on that track is more uncertain, the first observation serves to define the latter. By comparison with the "search ephemerides" computed in advance, with different assumed dates of perihelion passage, it appears that the comet will reach perihelion about June 14th. Dr. Crommelin, the distinguished computer of the motion of Halley's comet, predicted that this would occur on June 15th—with an uncertainty estimated at ten days, arising from the fact that he had estimated the effect of the perturbations by Jupiter, instead of taking the months of labor required to compute them exactly.

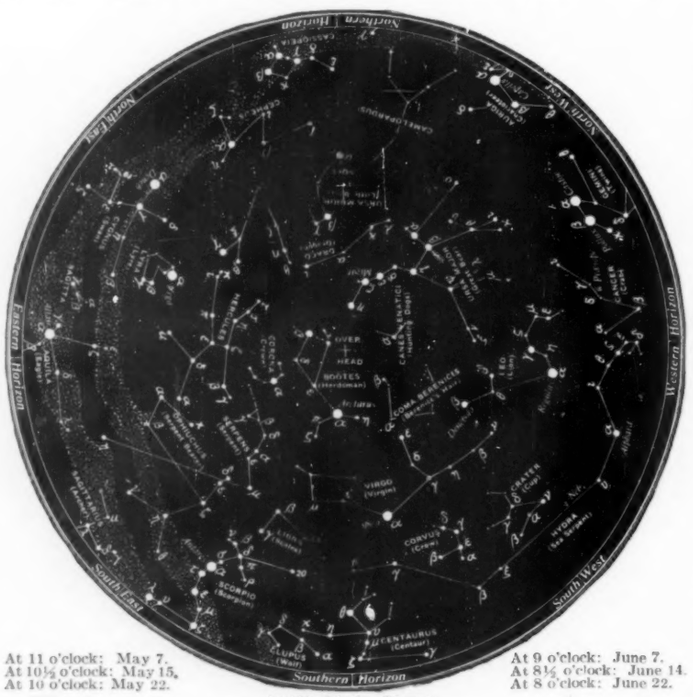
The Comet and Its Meteoric Swarm

Had the comet come a week later it would have passed the point of close approach of the orbits at the same time as the earth, and would have come within two or three million miles of us—perhaps closer. As things are, it will get there first, and be about nine million miles ahead of us. All through the first half of June it will be nearer to us than comets usually come, or than any other body except the moon ever comes; but its minimum distance will in all probability be several millions of miles—just how many can be told when a few more observations have been secured and a new orbit calculated. Before the exact date of the comet's return was known there appeared to be a chance—though a very small one—that it would actually hit the earth; but this seems to be placed now quite outside the bounds of possibility. Though we have no reason to expect anything so sensational as this, the encounter may nevertheless—and probably will—give us something to look at.

In 1916, eight months after the comet had passed the region where the orbits come near one another, large numbers of meteors were seen while the earth was passing the same region (which it does in the latter part of June). As in the case of all meteoric showers, these meteors moved in parallel lines which, by the effect of perspective, made them appear to radiate from a point in the sky near the end of the handle of the Great Dipper. Dr. Olivier of the University of Virginia and Mr. Denning in England, pointed out independently that this was exactly the direction in which meteors following along the track of the comet should appear to come. This added another member to the list of meteor showers known to be associated with comets. No shower of meteors from this radiant had ever been observed before 1916, but this was to be expected for in previous years the orbit of the swarm lay so far inside that of the earth that even the outliers did not reach us.

This year we shall pass within about one million miles of the central track, instead of three, and two weeks behind the comet instead of eight months. All the probabilities are therefore in favor of a conspicuous shower of shooting-stars. The most probable date is about June 28th, but it may come a little earlier or later, as the orbits of the earth and the comet run close together for a short distance. The moon will be in her last quarter and out of the way, since the meteors overtake the earth, and strike the evening, rather than the morning, side of it. A careful watch of the skies on and about this date is to be recommended to all star-gazers.

As for the comet itself, no ephemeris predicting its future position in the skies is yet available. Since in any case it is unlikely to become visible to the naked eye, and perhaps not even in a small telescope, this is of little importance from our present viewpoint.



At 11 o'clock: May 7.
At 10½ o'clock: May 15.
At 10 o'clock: May 22.

At 9 o'clock: June 7.
At 8½ o'clock: June 14.
At 8 o'clock: June 22.

At 9½ o'clock: May 30

The hours given are in Standard Time. When local summer time is in effect, they must be made one hour later: 12 o'clock on May 7, etc.

NIGHT SKY: MAY AND JUNE

The Heavens

Our map exhibits the evening constellations so clearly that little need be said. The Great Dipper, high in the north, points downward to the Pole-star, and in the opposite direction, following the curve of the handle, to Arcturus. Spica is well up in the south, and Antares is low in the southeast. Due south, and low on the horizon, observers within the tropics, or near them, may see the Southern Cross.

Leo is much the most conspicuous group in the west, and is brightened by the presence of Jupiter and Saturn. Gemini and Auriga are setting in the northwest. Cassiopeia swings low on the northern horizon, while Cygnus and Lyra are in the northeast and Aquila due east. Hercules, above the last, and Ophiuchus, in the southeast, complete our list.

The Planets

Mercury is in conjunction with the sun on the 10th, passing actually behind the body of the sun, so that he would be occulted if we could observe the phenomenon. He is however practically invisible except at the end of the month, when he is an evening star, setting at 9 P. M., and readily visible in the twilight.

Venus is just past inferior conjunction, and a morning star once more, rising about 4:10 A. M. on the 1st, and 2:45 on the 31st. On the 28th she reaches her greatest brilliancy, and is very conspicuous.

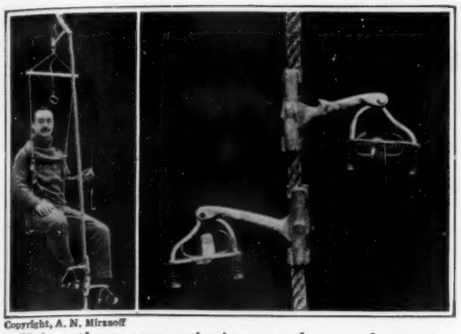
Mars is an evening star in Taurus, but is too near the sun to be seen under ordinary circumstances.

Jupiter is in Leo, and comes to the meridian at 7 P. M. in the middle of the month. On the 31st he is in quadrature east of the sun. Saturn is also in Leo and souths about half an hour later than Jupiter. Throughout the month we still see the dark side of his rings, illuminated only by light transmitted through the interstices in the rings, and by the feebler amount reflected from the planet itself, as explained in our article of last month.

Uranus is in Aquarius and a morning star. He is in quadrature on the 31st, and crosses the meridian at six in the morning. Neptune is also in quadrature, on the opposite side of the sun, on the 1st. He is in Cancer and is observable (telescopically, of course), in the early evening.

The moon is new at 4 P. M. on the 7th, in her first quarter at 10 A. M. on the 14th, full at 3 P. M. on the 21st, and in her last quarter at 5 P. M. on the 29th. She is nearest the earth on the 11th, and farthest away on the 27th. While she makes her monthly circuit she passes Uranus on the 2nd, Venus on the 5th, Mercury on the 7th, Mars on the 8th, Neptune on the 13th, Jupiter on the 15th, Saturn on the 16th, and Uranus again on the 29th.

Princeton University Observatory,
April 17, 1921.



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Using three rope-gripping members and a suspended seat, and a near view of two of the rope-climbing stirrups

A Pocket Stairway for Climbing Ropes

WHAT amounts to a pocket stairway for climbing ropes has been developed by a Frenchman, M. Paul Cans, and demonstrated by him with gratifying success. As efficient as this device is, its simplicity is undoubtedly the most surprising feature. Indeed, it is one of those devices which, when studied by us for the first time, call for the irrepressible exclamation—"Why didn't we think of that before!"

It will be noted by studying the accompanying illustration that the device consists of a stirrup for each foot, which is hinged to a lever terminating in a ring which, in turn, is pivoted to the framework connecting two fixed rings. The rope passes through all three rings. Obviously, when the stirrups are pressed down, the center or pivoted ring grips the rope firmly, but when the stirrups are raised the center ring is in alinement with the fixed rings and the rope is released.

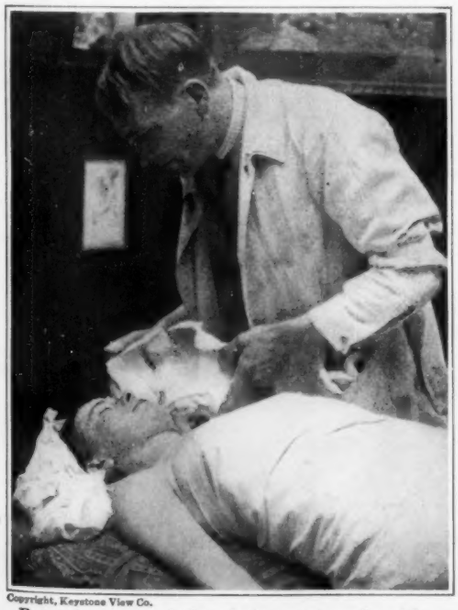
Now then, to climb a rope it is merely necessary to push on the first stirrup which is locked on the rope, while the second stirrup is released and slid upward; whereupon the second stirrup is pushed down, locking on the rope while the first stirrup is raised and released so as to be slid upward, and so on. Rapid progress can be made with this equipment. To slide down, it is merely necessary to raise the stirrups and the rope slides through the rings.

By using a third device from which the stirrup has been removed and in its place a suitable rig for a seat is used, it is possible for one to climb a rope and rest at any point without effort, since the weight pulls down on the pivoted lever and grips the rope, thus resting the feet.

Taking a Cast from a Living Model

SOME remarkable results in the way of faithful casts from living models have been obtained by the Belgian sculptor, Pierre de Zoette, by a simple method which he has devised. The face of the model is coated with a suitable grease, after which plaster of paris is applied. Provision is made so that the model may breathe, for the casting process lasts some eight minutes or more. Furthermore, a fine wire is placed in the plaster of paris mixture. After the plaster has hardened, the fine wire is carefully pulled up so as to cut the plaster mold in half to facilitate its removal.

This mold is, of course, a "negative." To form a "positive" the mold is assembled and the breathing hole plugged up, after which plaster of paris is poured in and allowed to set. Upon removing both halves of the mold a remarkable cast is obtained, which, after slight touches here and there to remove small flaws in the casting operations, is a photographically correct reproduction of the head of the model.



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Removing part of the plaster cast made with a living model in order to obtain a strikingly faithful reproduction

French Industrial Reconstruction

A RECENT report from the office of the American commercial attaché in Paris states that of the 4,241 industrial establishments in devastated regions of France, 3,239, or approximately 76.2 per cent, reported on October 1 that they had resumed operations either in whole or in part. In 1914 the total number of workers employed was 773,639, and on October 1, 1920, it is reported that the number employed in those establishments was 435,664, or about 44.6 per cent of the prewar personnel. It is noted that in the Lille regions 87.8 per cent of the industrial establishments have résumed operations; in the Department of the Ardennes 83.9 per cent; in the Department of Meurthe et Moselle 83.1 per cent; in the Department of the Nord 80.5 per cent, while in the Departments of Pasde-Calais and the Vosges, the industrial establishments that had resumed operations were 74.4 and 73.1 per cent, respectively.

Remarkable head-dress of a Mongolian duchess

Speaking of Odd Head-Dress

OUR engineer readers have an interesting problem on their hands in deciding just what form of reinforcing this Mongolian lady employs for her head-dress. At any rate this photograph was secured by Mrs. R. Chapman Andrews, wife of the Associate Curator of Mammals of the Museum of Natural History of New York City, while on a recent trip through China. The head-dress is typical of Mongolian nobility, and it is interesting to learn that our lady is a Mongolian duchess. Further proof of her social rank is to be found in the two red spots on her cheeks below the eyes.

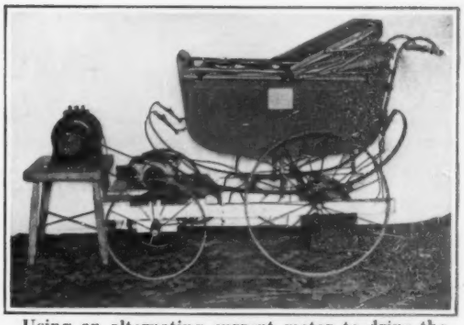
Electric Light from Waste Pipe Flow

AN ingenious and, withal, economical Frenchman, M. E. Colardeau, recently drew attention at a meeting of the Academy of Sciences to the many sources of energy which are wasted daily. If these were utilized the community would be saved many millions yearly.

As a concrete case he cited the way in which water is allowed to run out of the ordinary kitchen tap without its force being utilized. If the water flows, as is usual, from a cistern five meters above and at the rate of one liter per second, this flow provides sufficient power to keep charged accumulators necessary for the lighting of 20 lamps of 10 to 50 c.p. each.

In the country, where municipal water supplies of considerable pressure are absent, the scheme could also be put into practice, water being first pumped into a cistern by windpower, the same water being used continuously and drawn up from a reserve supply situated in the cellar.

M. Colardeau lights his own house in this way at Les Perreux, the apparatus he uses being contained in a box measuring 1 ft. by 2 ft. by 2 ft. The idea appears to be worthy of investigation.



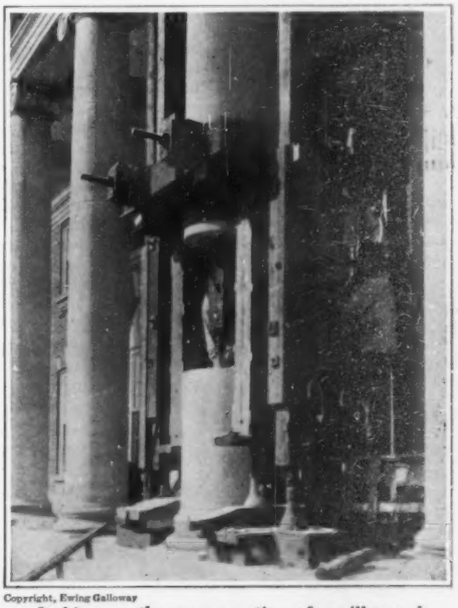
Using an alternating current motor to drive the perambulator motor for recharging storage battery during idle moments

When the Electric Motor Pushes the Baby Carriage

SOME day, when our statistical editor gets around to it, we are going to work up an interesting comparison showing how much horsepower is expended in the course of one year by fond parents pushing their offspring about the face of the globe, as compared with the total mechanical horsepower produced in the same period. In the meantime—and despite the awkwardness of not having exact figures at hand—we venture to present the electrically-driven perambulator which has made its appearance in England. This little vehicle has been designed to relieve the parents of some of the hard work of pushing their babies about, especially up steep grades. We are told that the English perambulator de luxe is provided with a 1/13 horsepower electric motor and a 6-volt, 80-ampere-hour storage battery. The motor drives the front wheels of the perambulator through a double reduction chain and sprocket drive. The battery is suspended at the rear and quite close to the ground. By driving the motor with another motor operating on any lighting current, even alternating current, the battery may be recharged in idle moments, as shown in the above illustration. A heavy wooden frame placed below the perambulator springs serves to carry the storage battery and the electric motor. The slow speed at which perambulators are driven makes the 1/13 horsepower sufficiently powerful for the work in hand, even on the steepest grades, it is reported.

Inserting New Sections in a Stone Pillar

THE accompanying illustration is of interest in that it depicts the method employed in removing defective sections and inserting new sections in large stone pillars. Clamps are placed about the upper section and a jack is inserted so as to raise it enough to permit of removing the defective section. The good section is then swung into position by means of a block and tackle, and the upper section is released until it finally rests firmly on the new section.



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Jacking up the upper section of a pillar and swinging new section into place with block and tackle

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Laminated wood bumper for automobiles, and springs which serve as mountings

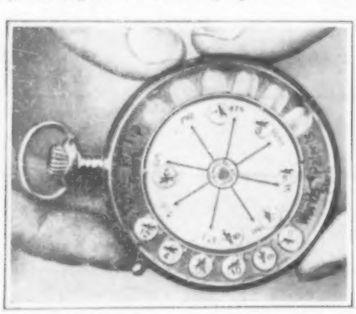
Laminated Wood for the Automobile Bumper

AMONG the latest developments in automotive engineering is a laminated wood bumper which, by replacing metal with wood in the bumper bar, embodies many desirable new factors.

As a matter of fact, wood has been largely overlooked in the automotive industry chiefly because of the fact that automobile engineers themselves have concentrated their study almost wholly upon certain metals and alloys. The use of wood in place of metal on a major scale actually dates from the airplane work during the war, when a lighter substitute of equal strength was required. Tests made then surprised many an engineer. For instance, few realized that, weight for weight, wood is actually greater in tensile strength than steel and other metals. Approximate values for static bending are represented by mild steel, 7½; aluminum alloy, 10; carbon spring steel, tempered, 17½; birch or hickory, 20. Only heat-treated chrome nickel steel shows a greater value, 26½.

Similarly in elasticity—the "give" so necessary in materials subject to impact—wood shows a notable superiority. In stiffness—the opposite to elasticity—approximate comparisons are: Steel, 29 to 31; aluminum or bronze alloys, 9 to 14; hickory and birch, ⅛ to 1 8/10; which gives by far the greatest absorption of shock, to wood. The time element is also distinctly in favor of wood, as it requires a measurably longer time to rupture wood.

All of which leads up to wood bumpers for automobiles, which have now made their appearance. The light weight of these devices reduces the overhang load fore and aft, making for easy riding. The new wood bumpers are built up of laminated wood, in which the factor of non-parallel fibers or "grains" adds greatly to the homogeneous quality. Thin sheets of carefully selected wood, in a single operation, are glued together under high pressure into a permanent unit and shape, after which several coats of special airplane propeller varnish are applied.



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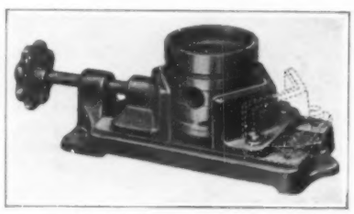
A miniature race track with twelve "horses" that may be carried in the pocket

A Piston Vise with a Firm but Harmless Grip

BY using a new piston vise recently introduced by a New York manufacturer, it is possible to hold any round or irregularly-shaped work without the danger of distorting or marring it. The jaws of this vise have four points of contact and it is claimed that this arrangement equalizes the tension and prevents distortion. In order to protect the piston the jaws are lined with lead. Through the fine thread screw pressure is gradually applied and the handle can be easily turned to any degree. One of the vise jaws is movable so as to receive larger work than usually handled. Triangular wood blocks attached firmly to the V-jaws make it possible to use the device as a parallel jaw vise.



A vise that holds the piston or other work firmly in place

A Lathe for Peeling Oranges

DOWN in Havana they have an ingenious method of peeling oranges which never fails to amuse the foreign visitor to the Cuban city. Street venders selling oranges offer to peel the fruit. This they do by placing the orange in the lathe-like device shown in the accompanying illustration, and then turn the handle until a cutter removes practically all the skin except at the two tips which have served to hold the orange in place. The skin comes off in one long peel, as shown, as the crank is turned. The cutter must be frequently resharpened.

A Race Track for the Vest Pocket

FROM Germany comes the ingenious game made in the form of a watch and depicted in the accompanying illustration. In truth, this is a miniature race track which is operated by pressing down the button in the upper right-hand corner. "Horses" numbering from one to twelve are kept in little "stables" around the outside of the race track on which from one to twelve "horses" can run according to the number of persons playing. When the button is pressed, the dial in the center spins around, taking the "horses" with it. The first "horse" at the finish post is the winner.

A Machine that Straightens Bent Spikes

A MACHINE for the purpose of reclaiming bent track spikes has recently been developed. Such a machine is particularly useful wherever trackage is used and especially where trackage is constantly shifted, such as in quarries, and so forth.

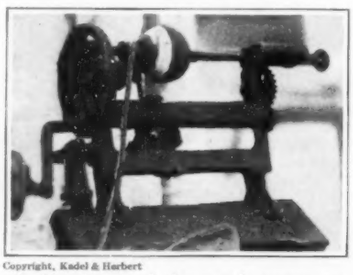
The old method of straightening bent spikes by hand was both dangerous and expensive and a very large percentage of the badly bent spikes had to be scrapped, as it took too much time and was exceedingly dangerous to workmen. The machine will straighten a spike that is bent and twisted at nearly right angles, and it also eliminates the old and costly method of handling and shipping to central points and then resorting. The machine weighs less than 70 pounds and can easily be taken to the job by the section men or bridge gang and all bent spikes be put back into service again. By putting the usable spikes back into service it reduces new spike requisitions and also keeps the scrap bin at the central points clear of usable spikes.

The spike-straightening machine is made of electric steel casting, heat treated, giving it strength, and the wearing parts are case hardened. The spikes are squeezed, thereby eliminating wear in the grooves.

This machine serves to bend the bent spikes back to their proper shape for further use

Better Fruit Packing with Less Work

AN "automatic" system for packing and wrapping fruit with all the advantages of the prevailing individual wrap and some others has been introduced on the Pacific coast. In fruit industries where highly-skilled and highly-paid fruit packers have been regarded as a necessity heretofore, the new method is one of the most talked-of subjects at this time. In one case, its introduction actually led to a strike of Chinese packers, who saw the high wages they had been earning slipping away from them. The new wrapping and packing system not only can quickly be adapted to inexperienced help, even children—it can be learned in a day—but it is considerably less expensive in materials.



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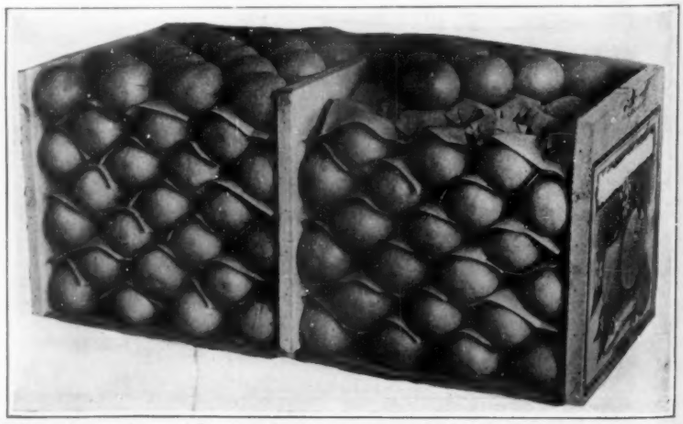
A few turns of the crank serves to remove all the skin from an orange

The new automatic system is known as the Sykes. It was devised by George Sykes. Its basis is the so-called separator wrap. This is a flat, pliable piece of cardboard the size of the apple box or other fruit container being used. At regular intervals on this cardboard there are radial cuts, the number of those varying with the sized fruit being packed. Thus the separator wrap used for apples, pears and other fruits and vegetables with a diameter of 3 inches to 3¾ inches has fourteen radial cuts. At these cuts the cardboard is slightly cupped.

The packer puts a wrap, sometimes called a "form," in the bottom of the box. He places an apple, stem down, on each cut or cup. Next, he places another wrap on top of this first layer or tier, reversing it so that the cuts or cups are not above the apples in the first tier. He goes on in this manner until he reaches the top of the box, when he takes a board slightly smaller than the inside of the box, places it on top of the packed fruit, and with evenly

(*Continued on page 378*)



Side and top view, with several oranges removed, showing the new separator wrap method of packing

Tilting Grain Cars in All Directions to Empty Them

(*Continued from page 361*)

any reason halted on their way to the bins aloft. Without this backstop the weight on one side of the elevator head and lack of weight on the other side would cause the elevator belt to reverse its action when the power went off. This is a common experience in other elevators and invariably causes several hours' delay.

Government regulations require that after weighing each car of grain the weights shall be removed from the scale to test the latter. To lessen the time consumed in meeting this requirement, a lever has been provided which lifts the weights free of the scales by a single movement of one arm.

These are but a few of the outstanding features of this structure which illustrates the last word in elevator construction.

Looking Backward 4,000 Years

(*Continued from page 366*)

who could afford it purchased such models to be piled around his coffin in his tomb and today every museum possesses a few. What was important in this case was the fact that Mehenkwetre was a person of great wealth who, to duplicate the bountiful existence he had led in this world, had supplied himself with a larger series of such models than has ever before survived to modern times. This survival we owe to the fact that his tomb architect had adhered to the archaic idea of the "serdab" and that this crypt had escaped the plundering of his burial chamber.

Each group or model was removed with extreme care, photographed, a minute chart made, and every figure numbered. The reader may wonder why so much labor should be spent in the cramped little chamber where one's head banged against the ceiling every time one forgot and stood upright. The answer is that no one can foretell what questions may arise in the minds of other students who did not have the luck to see the models in place. For example, it has been suggested that the boats sailing upstream should be placed with their prows to the south and those rowing down with their prows to the north. The photographs and the plan make it possible to reconstruct the position of every boat and the archaeologist at home will be able to answer the question to his own satisfaction.

Curious injuries to some of the figures suggest a clandestine visit of some children of the family some 4,000 years ago, who appear to have sneaked in and played with the figures and burned one of the masts and lost one of the arms of the fisherman. At last all the trayloads of models were safely under lock and key. All had to be photographed, for one-half of the find had to go to the Cairo Museum, while the other half went to the Museum in New York. There are twenty-four groups in all. They are pictures of daily life and only three have anything to do with the tomb or with the funeral. On either side of the chamber were statues of girls in fancifully colored garments bringing offerings to the tomb; wine, meats and bread, and each with a live duck in her hand. They are half life-size and are carved from wood. One group of four figures makes the other funeral group. All of the rest of the models pictured the life which Mehenkwetre lived here and which he expected to live in the hereafter. The most imposing of all is the noble counting his cattle, which is unfortunately in Cairo, but is shown in one of our illustrations. The slaughter house, the granary, the bakery, the brewery, the textile mill, the carpenter shop, are all to be found in these fascinating little groups. Two model gardens were found, one with a little copper pool to hold water and surrounded by fruit trees.

A great man like Mehenkywetre would be required to journey up and down the river, so he had vessels for business and vessels for pleasure and half of the models found are of boats and were typical of the Nile river craft 4,000 years ago. The models of boats are about 4 feet long and have crews of 12 to 18 sailors outside of officers. A sort of humorous fidelity inspired the maker of these ships. In the cabin of one sits a little steward beside a bunk under which are tucked two little round-topped traveling "hair" trunks very much like those of a generation ago.

A great man like Mehenkywetre come to New York will find the models in one of the Egyptian rooms on the Fifth Avenue side of the Metropolitan Museum of Art. Space does not allow us to show many of the models, but a much fuller article with many additional illustrations will be found in the SCIENTIFIC AMERICAN MONTHLY for June. The text is in the exact words of two of the members of the Expedition and it reads like a fairy tale.

Fuel Conservation Opinions—I

(*Continued from page 368*)

charge. The principal element of cost in steam plant operation is an operating charge. If manufacturing developments take place near water-power developments, power costs should be appreciably lower, and the gain substantially greater than the present condition of employing long transmission lines. Water power will certainly supplant steam power in the not distant future, states this company; but to this we must add the statements of others to the effect that water power can only supplant steam in regions well within the range of economical distribution. Where water power is not at hand, there can be no water power developments. Furthermore, many fuel authorities are agreed that water power is not a universal project that can be considered in general terms: each and every development should be considered by itself.

Bringing the Fuel to the Factory

During the days of war and the abnormal business activity following the Armistice and persisting up till a few months ago, many consumers of fuel experienced no end of difficulty in getting their fuel supply from the mine to the factory door. But with the present business depression and the general slowing up of railroad traffic, there is little or no real difficulty in this direction.

However things may be at this writing, it is certain that business must soon revive to full blast, so to speak, in which case large consumers of fuel will again experience difficulty in transportation. By the same token the suggestion of the Vice President of the Laclede Gas Light Company—that a working out of a scheme which would permit more regular mining throughout the year would help out transportation more than any one thing—might well be put into operation, even now.

The burden of transporting fuel can be lightened in a large measure if certain industrial districts will use the low grade fuels available near their plants instead of importing a higher grade supply from a distance, states a fuel authority who specializes in automatic stoking machinery. Until recently this importing of better fuel has been imperative in many cases because the stoking equipment then on the market would not give high capacities or flexibility with the lower grade fuels. However, there are stokers available today that permit of using these low grade fuels; and, once these stokers are employed in a big way, there will be a reduction in the unnecessary coal-carrying burden now borne by the railroads and lake boats.

The American Engineering Company of Philadelphia states that in its opinion there would be an undoubted advantage

(*Continued on page 377*)

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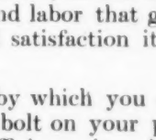

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Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Electrical Devices

FUSE.—G. E. CONRAD, Box 55, Stillwater, Minn. Among the objects of the invention is to provide a construction which will permit of a refill without the necessity of taking the body of the fuse apart, by simply loosening a pair of retaining screws. A further object is the provision of a fuse having means by which the filler, of soft metal construction may be protected, yet readily exposed to view so that its condition may be instantly determined without the necessity of test.

SEALING DEVICE.—A. W. WILDNER, Calle Maipu 671, Buenos Aires, Argentina. The invention relates to a device intended for office use and consists of a seal for stamping seals of sealing wax in combination with an electric heater. The sealing wax is conveniently prepared in the form of tablets, the heat from the electric coils gradually softening the wax to a degree at which it will take the impression of the seal.

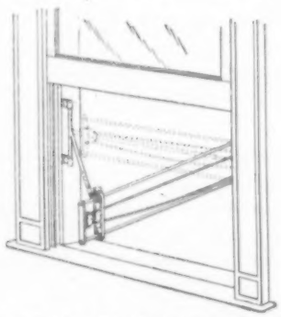
Of Interest to Farmers

MEANS AND METHODS FOR BUILDING SILOS.—F. THIEL, 108 William St., Hammond, Ind. An object of the invention is to provide means for building silos by the use of which the expense of erecting the ordinary scaffolding of lumber is obviated as well as the work and expense of again removing the scaffolding. A further object is to provide a series of portable hangers or scaffold units that are raised as the structure is progressively built up, and which may be lowered after the work is complete, and used over and over again.

DISK PLOW AND THE LIKE.—S. YUASA, c/o E. T. Nielson, Prospect Rd., Cupertino, Cal. It is the purpose of the invention to provide an auxilary disk mounted upon the frame which carries the plow disk in such manner that it may be manipulated to assume various horizontal angular positions relative to the frame and thus realize a practical advantage in turning a furrow close to fences, at fence corners and other like places.

Of General Interest

COMPENSATING SAFETY CLOTHESLINE HANGER.—A. HEYMAN and C. C. VERVOORT, 142 Newell St., Brooklyn, N. Y. The invention relates particularly to a type of hanger which may be withdrawn within a window, so that the clothes may be conveniently hung



VIEW SHOWING THE APPLICATION OF HANGER TO A WINDOW

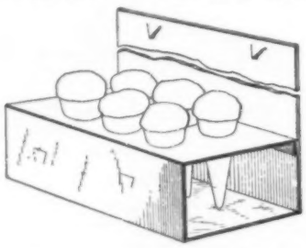
thereon. Among the objects is to provide a clothesline support of simple and rugged construction which is adapted to be positioned outside of the window when not in use, the support may be readily adjusted to windows of different sizes, and is arranged to prevent the possibility of collapsing when in use.

STRAINER.—L. DANIELS, 329 E. 14th St., New York, N. Y. The invention relates more particularly to a detachable strainer for coffee pots, the device being so constructed that it in no way prevents the closing of the lid of the pot. A further object is to provide a device which is simple and so constructed as to lie in proper position with regard to the spout, and requires a certain amount of force to effect a displacement, thus preventing accidental movement.

WARDROBE FIXTURE.—B. BRAGER, 84 5th Ave., New York, N. Y. An object of the invention is to provide a rail member having an integral downwardly projecting handle for the manipulation thereof in any direction with respect to a fixed channel member. A further object is to provide a support for garments or the like provided with facilities for supporting trousers, skirts, etc., in the best possible position.

SAFETY DEVICE FOR WELLS.—J. F. MC. DOWELL, 2015 Laurel St., Shreveport, La. The invention has for its object to provide a device which may be arranged at the top of the well casing, about the drill stem or other tools, for preventing downward movement of the tools during the raising thereof, the said means having means for gripping the stem when it moves downwardly and for releasing the stem when it moves upwardly.

CONFECTION CONE CARRIER.—J. J. BOTNEN, Abererombie, N. D. This invention relates to carriers formed of cardboard for carrying cones containing ice cream, the object being to provide a carrier which effectively supports a plurality of cones without the necessity



A PERSPECTIVE VIEW OF THE CARRIER WITH LID BROKEN AWAY

of providing an additional means for supporting the carrier during such operation. The invention allows of the formation of such carrier with a minimum quantity of cardboard, at the same time providing a cover as well as a support for the ice-cream cones.

RULE HOLDER.—C. R. D. KANE, 524 2nd St., Hoquiam, Wash. This invention relates more particularly to an inexpensive device whereby folding rules may be effectually held in rule pockets of overalls and work garments against danger of accidental displacement, and in such way as to permit of ready removal of the rule when desired. The device may be readily secured in place.

CASEMENT WINDOW.—L. LANE, P. O. Box 1066, Habana, Cuba. The invention more particularly relates to a metal window frame and sash. A specific object is to provide an embodiment that may be produced from few elements of simple form and resulting in a strong and weather-tight casement by the ordinary methods of manufacture employed in the quantity production of metal sashes and window frames.

OILING DEVICE.—A. BLUMENTHAL, c/o Bronx Novelty Works, 3476 3rd Ave., Bronx, N. Y. The object of the invention is to provide an oiling device arranged for thoroughly rubbing oil or similar liquids on wooden floors and the like. Another object is to prevent scratching or other injury to the surface treated and to permit of conveniently oiling a large surface with a single charge of oil and without requiring much physical exertion on the part of the operator.

BOX FOR ARTICLES OF PERFUMERY.—J. A. L. DUMONS, 171 Rue Ordener, Paris, France. The invention has for its object the provision of a box designed to contain and to retain firmly during use various articles of perfumery such as shaving soaps, dentifrice soaps, blocks of solidified brilliantine, compressed rice powder, etc. The device is arranged in such manner as to collect the excess lather and water, or the material which runs over the edge, at the same time insuring that the product is firmly held.

Hardware and Tools

DOOR HANGER AND ADJUSTER.—E. G. MORIN, 4004 20th St., San Francisco, Cal. The primary object of the invention is to provide a hanger which is simple, inexpensive, reliable, practically noiseless, capable of being readily and easily adjusted and which may be easily assembled and fitted without necessitating any change in the door frame or wall construction or the provision of special wall and door frame construction.

FOLDING SHUTTER.—M. D. LAFUENTE, Calle Maipu 671, Buenos Aires, Argentina. This invention relates to a metallic shutter, substantially characterized by the particular manner in which the parts which constitute the structure, are folded and lodged within a recess or cavity formed at one or both sides of the frame, according to whether the shutter consists of one or of two doors or parts.

Heating and Lighting

RADIATOR PLUG.—C. J. BROWN, Box 375, Hamilton, Texas. The object is to provide a plug for sealing the tubes of radiators with a fluid-tight joint, thus permitting the usual sealing caps to be dispensed with. The device comprises a spherical body of resilient material, caps disposed at opposite sides of the body, a bolt passing through the body and caps, and a clamping nut threaded on the bolt, the caps having their edges serrated and inturned for penetrating engagement with the body to prevent rotation.

Machines and Mechanical Devices

PISTON RING.—J. MILLER, 206 Central Ave., Albany, N. Y. This invention relates to a sectionalized piston ring having similar sections oppositely disposed and each tapering uniformly from the middle to both ends, whereby uniform tension is obtained and an effective fit produced between the piston ring and cylinder, the meeting faces of the rings having shallow grooves extending half-way around each section, such grooves insuring the maintenance of a film of oil between the sections.

AIR COMPRESSOR.—E. A. GOLLE, Grand Beach, Mich. The invention more particularly relates to compressors of the rotary type. The prime object is to provide a device in which the air may be compressed with greater efficiency than is capable of machines at present in use. A further object is to provide a device which is simple in both construction and operation.

Musical Devices

PHONOGRAPH SOUND BOARD.—W. A. SCOTT, Box 78, Parkwood, Oreg. The object of this invention is to provide a device wherein the volume of tone is increased while the quality of the instrument is rendered with clearness, and in reproducing the voice; it also adds to the distinctness of the words being spoken, the sound board being combined with an amplifier and forming a part thereof.

STOP FOR PHONOGRAPHS.—R. BARTOLOMEH, 240 W. 24th St., New York, N. Y. The invention relates to a stop which will be actuated automatically upon the reproducer reaching the last groove of the record. By this device it will not be necessary to insure the stoppage of the turn table, even though the record varies with respect to the number of convolutions of the spiral groove in its face.

Prime Movers and Their Accessories

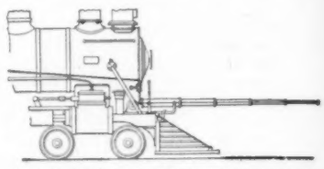
CRANK-CASE BREATHER FOR INTERNAL COMBUSTION ENGINES.—H. C. MILLER, Genoa, Neb. An object of the invention is to provide means for supplying the crank case with lubricating oil required by the engine and prevent undue compression within the crank case, and the entry of dust and grit into the crank case, and to retain entering dust and grit against entrance of the crank case and provide means whereby the same may be readily cleaned out or removed as required.

INTERNAL COMBUSTION ENGINE.—C. L. MACVEY, c/o Foster's Jewelry Store, Monroe, La. An important object of the invention is to provide a construction of rotary valve by use of which the four functions of intake, compression, firing and exhaust may be performed upon one complete revolution of the valve. A further object is to provide an engine having gravity operated means for lubricating the rotary valve, and for feeding the used oil from the valve to the interior of the cylinder for lubricating the piston, the spent oil being subsequently exhausted from the cylinder.

AUTOMATIC FUEL FEEDING DEVICE.—A. S. KING, c/o First State Bank, Pawnee City, Neb. The invention relates to devices for automatically feeding the liquid fuel from the storage tank to the carburetor of an internal combustion engine. A further object is to provide a device which is simple in construction and liable to easily get out of order and in which the feeding of the fuel is rendered positive through the action of the engine.

Railways and Their Accessories

MEANS FOR DRIVING LIVE STOCK FROM RAILROAD TRACKS.—W. A. WILLIAMS, 601 E. Cheves St., Florence, S. C. The object of the invention is to provide a series of telescoping tubes at the front of a locomotive with a view to allow water or steam to pass out



A SIDE VIEW OF THE DEVICE APPLIED IN EXTENDED POSITION

of the outermost tube in a stream a distance along the track to drive the cattle off and thus avoid the killing of such live stock. Another object is to enable the engineer to readily apply such means and to permit of its being normally folded to take up very little room.

Pertaining to Recreation

ROLLER SKATE.—B. F. SPENCER, Box 213, Los Angeles, Cal. The purpose of this invention is to provide a skate in which the foot plate and the clamping plates as well

A VIEW SHOWING THE SKATE APPLIED

as the supporting brackets of the wheel are formed from a single sheet of metal, thus permitting the stamping of the same and thereby materially reducing the cost of manufacture.

Pertaining to Vehicles

TIRE.—O. BUSE, 824 Second Place, Plainfield, N. J. An object of the invention is to provide a tire having projections which are made hollow and in which cementitious inserts are embedded securely anchored in the tire and located flush with the outer face of the tire so that this material, when hardened, forms an artificial stone insert which constitutes a permanent fixed part of the tire.

REFLECTOR.—E. ZIMMERMANN, JR., 137 Lincoln St., Hudson Heights P. O., N. J. The invention relates more particularly to reflectors for automobile headlights, an object of the invention being to provide a reflector which can be inserted in an ordinary headlight casing without altering the construction, and which will increase the area and power of the illumination and at the same time diffuse or soften the light so as to prevent glare.

Designs

DESIGN FOR A PEN-HOLDING ATTACHMENT FOR INK BOTTLES.—J. J. HARPUR, 5512 Walnut St., Shadyside, Pittsburgh, Pa.

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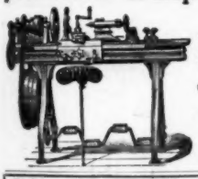

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"Wonder" Cold Pipe Bending Machines (Pat.) electrically operated to bend from 1 in. to 8 ins. Send for printed matter. We also manufacture TEN other sizes, hand operated to bend from 1-8 inch to 6 inches.

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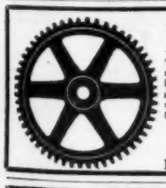

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$22.75 Each

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Fuel Conservation Opinions—I

(*Continued from page 375*)

for the coal operator and for transportation if fuel were allocated to particular districts and the users were required to estimate their annual needs. It is customary at the present time for all users to accumulate a maximum surplus prior to winter conditions of transportation. While there are a number of disadvantages against storage of coal in spring, which coal is to be used the following winter, due to deterioration and so on, and a further disadvantage of probable lower costs later, much could be done in this direction to relieve the intensified demand in the late fall.

From the railroad standpoint, Mr. A. T. Hardin, Vice President of the New York Central Lines, states that under ordinary conditions no particular trouble is experienced in the transportation of fuel. Where the New York Central Lines do not directly reach the mines, they are reached by intermediate connections and the haul to junctions with their lines is comparatively short. It is customary during the summer months when the coal market is dull to secure a surplus supply of coal which is stored at points on the line that are most remote from the coal fields, to be used during periods when there might be interruptions to traffic. A number of industrial plants follow the same course. During the past five years there have been so many unusual conditions to contend with that the distribution of commercial coal, and to some extent the railroad coal, has been irregular; but under normal conditions there is no difficulty in distributing coal regularly.

Also typical of railroad opinion is the remark of Mr. Bean, Mechanical Assistant to the President of the New York, New Haven & Hartford Railroad, to the effect that it appears reasonable to believe that railroads could very largely offset coal distribution difficulties if more of the users of coal would carry a reasonable amount in stock—accumulating said stock during periods when demands for coal are the least.

In an early issue this fuel symposium will be concluded, with particular emphasis on the fuel conservation phase and the suggestions bearing on new fuels and future sources of power.

Cold Vulcanization of Rubber

(*Continued from page 369*)

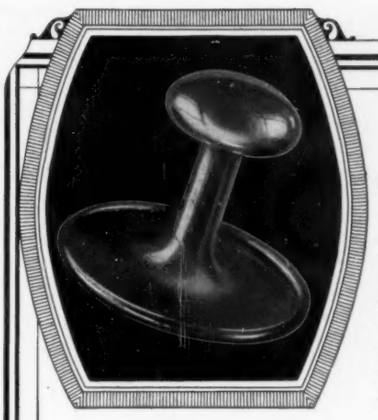
corporate delicate organic dyes, etc., where before only coarse inorganic pigments were allowable, delicate dyes having been destroyed by the combined action of the heat and the sulfur. Beautiful fabrics and wall coverings in the new rubber have been produced. As regards physical properties it is quite equal to the product of the old hot process, and superior to that of the old cold process. It is also possible to work up organic matter and fiber in the mass of the rubber, securing toughness and the hard wearing properties suitable for rubber soles, pneumatic tires, etc.

By the new process it is also possible to vulcanize rubber in solution, a feat not hitherto possible. If a solution of rubber in any of the usual solvents, benzine, toluene, etc., be treated alternately with sulfur dioxide and sulfuretted hydrogen, the thin solution rapidly thickens and forms a jelly which can be put to many uses, it being possible to coat fabric in this way with vulcanized rubber in one process. Previously the fabric was coated with rubber in solution, the solvent evaporated, and the fabric then vulcanized.

The great advantages which render the Peachey process of fundamental importance are:

(1) No heat is required, and to a great extent mechanical pressure may be dispensed with.

(2) It is a true sulfur vulcanization, like the original Goodyear process. Sulfur chloride treatment is not.



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BECAUSE the collar button made of a *single* piece of metal wears longer. It is better value than the button with separate base that may wear and fall off.

"PARKROGER"
ABSOLUTELY ONE-PIECE
COLLAR BUTTONS

are the *only* buttons made from a single piece of rolled gold plate—gold on *both* sides. Positively no base to wear loose. Can't stain or poison the skin. And made in a variety of styles to fit every man's needs or fancy.

Guaranteed to satisfy or a new button free. Ask your haberdasher or jeweler for PARKROGER

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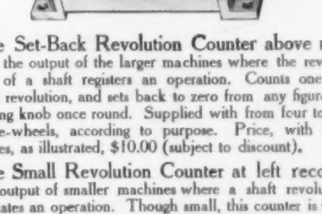
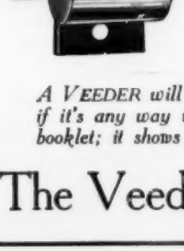
Since Price Moves the Goods—

Get a better price on your machine operative's work—paying only for the amount actually produced, and recorded on a Veeder Counter. You buy a definite, registered production, not just *services* of variable value, from the man whose machine is equipped with a

Veeder COUNTER

The large Set-Back Revolution Counter at right is less than ½ actual size. The small Revolution Counter below is shown nearly full size.





The Set-Back Revolution Counter above records the output of the larger machines where the revolution of a shaft registers an operation. Counts one for each revolution, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, according to purpose. Price, with four figures, as illustrated, $10.00 (subject to discount).

The Small Revolution Counter at left records the output of smaller machines where a shaft revolution indicates an operation. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially adapted to light, fast-running machines. Will subtract if run backward. Price, $2.00.

A VEEDER will make any machine produce more cheaply—if it's any way up to the operator. Write for the Veeder booklet; it shows many counters suitable for your operations.

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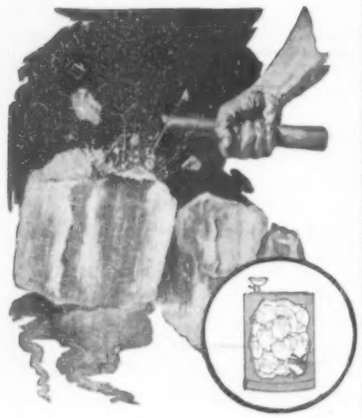

None of this work and waste With a Jewett

PERHAPS you have never considered the enormous amount of labor and money wasted with the ordinary round type cooler. The ice delivered in cake form, has to be broken into small pieces so that the cooler can be packed. Ice broken up melts much quicker than ice in large cakes and round coolers often require refilling twice a day.

There is none of this with the Jewett. The Jewett is square and takes a complete cake of ice. The walls are insulated with pure cork 1½" thick which keeps in the cold and locks out the heat thus further reducing the ice fills at least 25%. With ordinary coolers the ice and labor wasted soon cost more than the cooler itself.

You can buy Jewetts Direct from the Factory

and save the dealer's profit. Any handy man can connect it to your regular water supply system. In winter it can be used without ice.

The Jewett's improved, angle-flow bubbler, which makes it impossible for a workman to drink directly over the bubbler, eliminates any possibility of contamination. No dangerous tin cups or dippers. No expense for paper cups. A glass can be easily filled from the angle-flow stream.

Plan NOW to install a water cooler system this summer—don't wait until hot weather begins to reduce production. Send today for detailed information and quotations.

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(3) It is rapid and cheap—the two gases can be produced on a large scale.

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The process has been extensively tried out on a laboratory scale and is in process of transference to factory practice. No difficulties are foreseen in the transference since the simplicity of the process makes large scale working quite as easy as small scale.

Machine-Made Window Glass

(Continued from page 370)

the glass plastic so that it will bend at right angles in running over the roll and out to the flattening table and lehr, the growing sheet runs the gauntlet of a series of gas jets.

From the flattening table the lengthening sheet of glass is carried mechanically to the lehr, and when reaching this annealing furnace the bait is broken free of the glass and lifted out through an opening in the top of the lehr. At the same time, clamp bars grip the sheet and force it onward; and this operation continues the process of extracting the glass from the tank without further recourse to the bait. The conveyor within the lehr consists of a series of power-driven rolls, placed transversely every 12 inches throughout the entire length of this furnace. These rolls insure a uniform drawing impulse; and should a sheet of glass break in transit through the lehr the rolls will carry the pieces right along to the cutting table at the farther end of the annealing chamber. At the lehr exit the issuing glass runs under cutters, placed at each side of the sheet, which automatically trim the edges; and the uneven scrap drops into a hopper placed beneath the table. The hopper discharges on to a conveyor, which bears the scrap glass, known as cullet, to a crusher in the batch room, from whence it is fed from time to time into the melting tank.

Should a drawing machine be stopped for any reason, it is set going again by the following procedure: First, the elevating gear is reversed so as to allow the bait to pass through the apparatus and to descend into the tank until it is in contact with the purified molten glass in the drawing receptacle. Next, with this done, the machine is started in the opposite and normal direction, the bait is raised, and the sequence of the extraction of the sticky, tenacious material goes on, as described, uninterruptedly for days. From the time the glass leaves the tank, in the case of "single-strength" sheets, until it is cut upon coming out of the lehr is a matter of only 40 minutes.

It will be readily grasped that the thicker and the wider the sheet the more deliberately will the bait be moved in effecting the initial extraction of the syrupy glass; and this pace is thereafter maintained so that sufficient material will continue to follow from the tank so long as the machine is running. The speed is varied to suit the different thicknesses or "strengths" of the window glass being made; and the rate of travel is subject to perfect control. Herein arises one of the niceties of the industry, for the viscosity of the glass in the molten state likewise influences the rapidity with which it can be manipulated to insure prescribed results. The temperature of the glass and the composition of the mixture affect the viscosity.

In order to obtain satisfactory functioning, in view of the peculiar nature of glass and the temperature limits within which it can be worked, the engineers have been required to make certain of smoothness of operation and an absence of any vibration that might cause the glass to fracture or tear loose at a critical stage. Jarring of the bait would surely lead to trouble, for the molten glass would cling unevenly to the bar and therefore not trail after it in a manner to form an acceptable sheet. Similarly, when once the bait has fulfilled its duty, and further extraction proceeds automatically, any sudden tug or one-sided pull over the roll would be apt to disrupt or to disturb harmfully the uniform upward flow of the unstable substance. The fact that these untoward happenings have been cunningly guarded against to an astonishing degree is the best evidence of the thought and skill that has gone into the evolution of these remarkable glass-making machines.

At Charleston sheets of glass 58 inches wide and 3/16 of an inch thick are made regularly, and improvements are in hand which will permit the drawing of sheets 82 inches wide. It is reported that the operation of the equipment at the West Virginia plant has been so carefully regulated that the edge waste has been cut down more than 50 per cent. This means, of course, that a greater quantity of marketable glass is secured during a working period. Efforts are being made, with promise of success, toward adapting the Libbey-Owens apparatus to the manufacture of wire glass.

A belief has been fostered that hand-blown window glass is better than the machine-made product principally because the repeated reheating of the hand-blown material anneals it more thoroughly. This claim is now disputed, and it is said that by the process under discussion it is practicable to obtain a perfectly annealed glass of fine finish, uniform thickness, and flatness. Apparatus of this type have been installed in Canada and Japan, and the intention is similarly to equip a large factory in Belgium. So much for the expansion of a phase of the industry which has forged to the front despite much discouraging criticism. But let us return to the operative cycle at the Charleston establishment.

The sheets of glass, after they issue from the lehrs and are cut into convenient lengths, are trucked into the cutting room and delivered to the cutters, where they are subdivided into commercial sizes agreeably to orders. Underneath the cutters' chip boxes runs a carrier that mechanically empties these receptacles and transports the waste to the main cullet conveyor which, in turn, delivers it to the crusher already mentioned. It is not alone in the actual production of glass that steps have been taken to hold to a minimum the number of human workers. Wherever possible mechanical facilities have been pressed into service. The plant has a yearly capacity of 2,500,000 boxes of glass.

For instance, the box factory, which is at one end of the plant, with the hay storage adjoining, is equipped with box-making machines, and the containers, with the needful hay packing, are lifted and transported to the cutting rooms. As they move along, the boxes are automatically tripped and sent down an incline to the packers. From there, the shipments are taken away by electric trucks and shifted to the ground floor on hydraulic elevators where railway cars, under cover, are in waiting.

According to the latest figures available, we manufacture annually about 9,500,000 boxes of window glass containing 50 square feet each, and approximately 60 per cent of this output is machine-made. More than $4,000,000 is invested in the factories engaged in this department of the glass industry.

Better Fruit Packing with Less Work

(Continued from page 374)

distributed pressure pushes the packed fruit down and together. Then he adds another tier.

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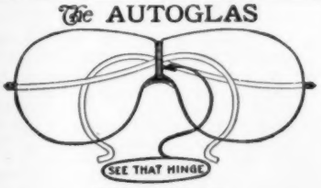

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box is equal to, and sometimes more than, those in a box packed by the individually-wrapped system. It is declared that there are thirty-two channels of ventilation leading to each center apple, and that the fruit consequently keeps well, better even than in the individual wrap. When the dealer comes to display the fruit, he takes off the side of the box, and has an attractive display without the necessity of unwrapping and thereby destroying the pack.

The system is said to be based on exact mathematical calculation, and fits to a given space as many round objects of the same weight and size as can be put there. The structure is four complete circle arches of six objects around a center object, which is declared the strongest possible. Experience indicates that the fruit carries as well as that packed by the old system.

The great attraction of the Sykes system is its economies. The recent increase in transportation rates has reduced the margin that Pacific producers work under, and the situation becomes easily conceivable in which several cents saved on packing would be of crucial importance. The new "automatic" method on the labor side not only requires less skilled, and consequently less expensive help, but a smaller packing force. In practice three packers using the separator wrap will equal the output of four using the individual wrap.

On the material side, there is a saving on paper of one-half to two cents a box.

Tomatoes, peaches, pears, apricots, oranges, lemons, and other fruits were commercially packed the past season by the new method. An example of its capacity is pointed to in pears, one of the most difficult of fruits to pack. There is a saying among fruit growers that it takes four years to make a good pear packer, under the individual-wrap system. Any inexperienced hand can be taught to pack pears by the separator wrap method in a few hours. With this fruit, as with others, the packer uses two hands for actual packing. There is no labor of fitting as with the old system.

How to Tell Birch, Beech and Maple Apart

BIRCH, beech, and maple are very similar in appearance, and have approximately the same weight. Hence it is comparatively easy to mistake one of them for another. A method which anyone can use to distinguish them is suggested by the U. S. Forest Products Laboratory. The method makes use of the relative width of the pores and medullary rays in the three woods.

If the end grain of birch, beech, or maple is cut smooth with a sharp knife and examined with a hand lens, the pores will be seen as tiny holes distributed fairly evenly over the surface, and the medullary rays will appear as narrow lines of a different shade running at right angles to the growth rings.

In beech some of the rays are very distinct even without a lens. The large rays are fully twice as wide as the largest pores.

In maple the rays are less distinct, and the largest are about the same width as the largest pores.

In birch the rays are very fine, invisible without a lens. The pores are several times larger than the rays, usually being visible to the unaided eye as minute holes on the end grain and as fine grooves on dressed faces of the board. The pores in birch are considerably larger than the pores in beech or maple.

The appearance of the medullary rays on a "quartered" surface is also distinctive. Here they appear in beech as distinct "flakes," the largest being between 1/16 and 1/8 inch in height when measured along the grain of the wood. In maple they are considerably smaller, rarely attaining a height of 1/16 inch. In birch they are comparatively inconspicuous.

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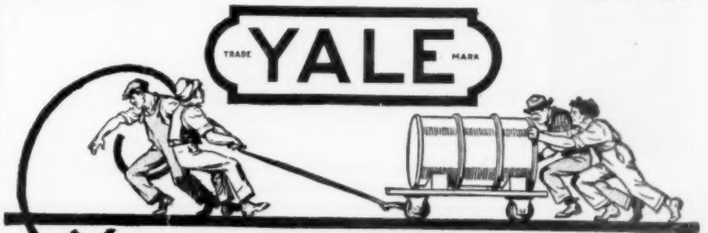

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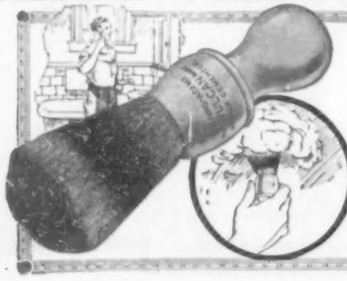

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A MANUAL OF CANNING AND PRESERVING. By Theodora M. Carrell. New York: E. P. Dutton and Company, 1919. 12mo.; 101 pp.

From the depths of a varied experience the author recovers for the housewife recipes and methods by which an opulent array of foods may be preserved in their original coloring, flavor, and nourishing qualities. Her instructions are precise, interesting, and complete; the cold-pack method is of course included.

LIFE. A Study of the Means of Restoring Vital Energy and Prolonging Life. By Dr. Serge Voronoff. Translated by Evelyn Bostwick Voronoff. New York: E. P. Dutton and Company, 1920. 8vo.; 169 pp.; 39 plates.

One by one, old dreams come true. But we have discarded the devil, and our modern Faust will seek the operating table instead. The SCIENTIFIC AMERICAN MONTHLY for November recounted the experiments of the Austrian, Steinbach. Now, in this absorbing book, Voronoff records his own successes in testicular and thyroid grafting, by means of which animals and men have been startlingly rejuvenated. His straightforward account makes plain both methods and results; he is confident that the surgery of the future will be the grafting of organs, tissues and glands, and that the ape will be the guardian of vital energy transmissible to man. The effects seem to be authenticated; what we do not yet know is how long they may be expected to last.

MATTER AND MOTION. By J. Clerk Maxwell, M.A. New York: The Macmillan Company, 1920. 12mo.; 163 pp.; illustrated.

It is well that this little classic should appear in a reprint wherein its bearings on modern theories of relativity are pointed out in a lucid appendix by Sir Joseph Larmor. Maxwell had the faculty of crystal expression. In "Matter and Motion" he generalizes from the simple particle to complex physical systems and deals with the fundamental principles of dynamics. There is a fine portrait and a biographical sketch.

THE AMERICAN BOYS' HANDYBOOK OF CAMP-LORE AND WOODCRAFT. By Dan Beard. Philadelphia and London: J. B. Lippincott Company, 1920. 8vo.; 270 pp.; 377 illustrations.

Dan Beard opens his duffel bag again for the delight of the outdoor boy; as usual, it contains big medicine—fires without matches, ways of laying fires for various purposes, little pointers that make for comfort in the camp, something about horses and saddles and dogs, and the expert wielding of the ax; directions, too, for laying out a council ground, and the ritual of the council fire. In the author's numerous pen-and-ink sketches are pictured most of the devices and stunts about which he writes.

MODERN EXPLOSIVES. By S. I. Levy, B.A. New York: Isaac Pitman and Sons, 1920. 12mo.; 109 pp.; 11 illustrations.

The writer's connection with the British Department of Explosives during the war gave him unusual opportunities for studying comparative methods of manufacture in European countries, including Germany. While his meaty little book carries much objective knowledge relating to raw materials, the acids section, the preparation of high explosives, etc., it also brings out the interdependence of modern industry, surveys research and productive activity as a whole, and gives newly-found basic principles in non-technical language.

DETAIL DESIGN OF MARINE SCREW PROPELLERS. By Douglas H. Jackson, M. I. Mar. E. New York: Isaac Pitman and Sons, 1920. 8vo.; 92 pp.; illustrated.

In designing propellers, it is a difficult matter to bring theory into harmony with concrete conditions. Mr. Jackson seeks to do this for the average student, who is apt to lose himself in the treatise of the expert. The text outlines accepted theories, treats very fully their practical applications, and describes manufacturing operations. With its many tables, cuts, and folding inserts it constitutes a good handbook for the student and the draughtsman-designer.

GOLD. Its Place in the Economy of Mankind. By Benjamin White. New York: Isaac Pitman and Sons. 12mo.; 128 pp.; illustrated.

The relation of gold to banking and exchange is of paramount interest. The author is a member of the Institute of Bankers and of the Royal Statistical and Royal Economic Societies; he gives us a concise account of the way in which gold assumed its value in these relationships, embracing the history of its production and uses. Its present production and prospects, world mintage, and the gold standard are presented and explained, with chapters on stocks, gold and the war, and industrial uses.

POLITICAL AND COMMERCIAL GEOLOGY AND THE WORLD'S MINERAL RESOURCES. J. E. Spurr, Editor. New York: McGraw-Hill Book Company, 1920. 8vo.; 562 pp.; maps and graphs.

Twenty-seven specialists who followed mineral problems closely during the war give us these studies of the commercial control of raw materials by different powers, and of the related questions of our domestic and foreign policies. The multiplication of humanity, with the fierce competition engendered, enters into the equation, while the metals are the basic element of it. Sentiment only follows expediency; the heart of Alsace-Lorraine is iron; the soul of Silesia, coal. The work would make America conscious of what Europe has long recognized: that, as natural resources dwindle, certain principles involving foreign trade awake and function; it is high time that we, too, awake to the facts and set ourselves wisely and energetically to meet them.

THE "WELLCOME" PHOTOGRAPHIC EXPOSURE RECORD AND DIARY. 1921. New York and London: Burroughs Wellcome & Company. 18mo.; 260 pp.; illustrated.

A little better each year, this pocket book with its cheery red cover holds much of interest to any camera man. Exposure commands the space to which its importance entitles it, and the ingenious calculator affixed to the back cover is, as always, a feature. Among newer phases dealt with in the brief articles are aerial photography, color work and telephotography.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES. For Buyers and Sellers. New York: S. E. Hendricks Co., Inc., 1921. 4to.; 2572 pp.

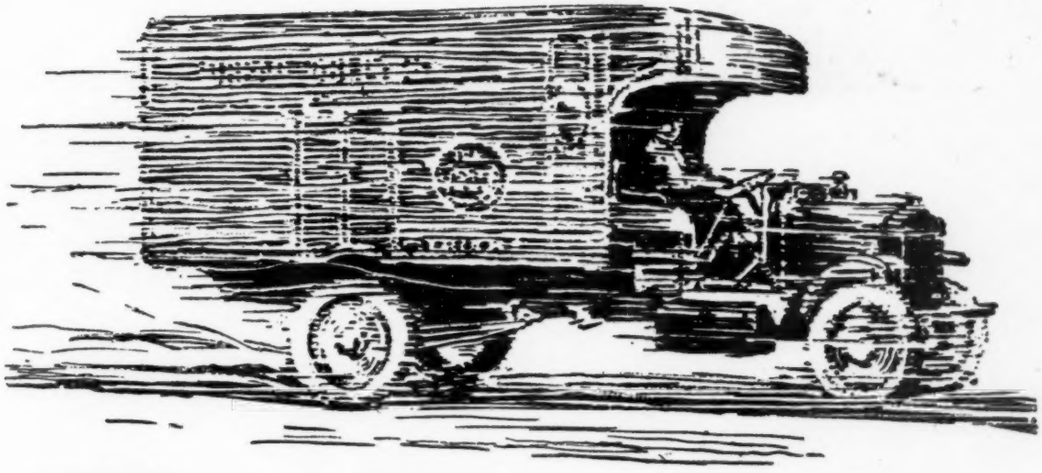
Charles Lamb divided mankind into those who borrow and those who lend. Today a juster classification would be those who buy and those who sell; but we are all buyers and sellers by turn. In whichever category you may find yourself at the moment, this trade register, rejuvenated every year, will give access to complete, reliable information as to producers, manufacturers, dealers and consumers. It has a classified trades section, a long list of trade names, brands, etc., and an alphabetical section. Any source of supply or demand, whether for raw material, finished article, or service, may be quickly found from the firm name, the general name of the product, or the trade name. The register is also in wide use for mailing lists, and is justly appreciated by the many factories, machine shops, mills, mines, railroads, and municipalities that use it.

LIBERTY MAI OF NEW EUROPE. New York: Funk & Wagnalls Company, 1920. 4½ feet wide by 3½ feet high.

In no way can the profound changes resulting from the war be better followed than from this *Literary Digest* map, which includes Africa. The State Department and the American Geographical Society have coöperated with some of our best map makers to produce a graphic guide to developments in Russia, France and Germany; shrunken Austria and circumscribed Turkey, the new Balkan alinements and the many other changes, are plainly shown. A complete index locates 12,000 towns, rivers, etc. It is such a map as no school, library or home should lack, and is obtainable either on durable map bond paper, folded and pouched, on map cloth, folded, or as a cloth-mounted wall map, on rollers.

THE NEW WORLD OF SCIENCE. Its Development During the War. Edited by Robert M. Yerkes, Chairman, Research Information Service, National Research Council. New York: The Century Company, 1920. 8vo.; 443 pp.; 21 plates.

"Can any good thing come out of"—Armageddon? One good thing, at least, did. War forced us to mobilize our scientific resources, not only in producing and surpassing German products upon which we had too long relied, but also in research that enabled us to locate hidden guns by sound, to meet poison gas with thrice-poisonous gas, to shoot better, fly better, and to find the secret mechanism of obscure disease and wage effective war against that. In this notable book, authorities tell the dramatic story of the rôles played by physical science, chemistry, engineering, and biology in the war, and set forth the way in which we shall turn our new knowledge to advancement in the arts of peace. A profound respect for pure science, the father of material comfort, safety and progress, is instilled in the mind of the fortunate reader.



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